BELFAST

and adjacent counties.

British Association

1902.

914.161

LONDON BOROUGH OF LEWISHAM
LIBRARY SERVICE

Author

Title

BOOK STORE

Books or discs must be returned on or before the last date stamped on label or on card in book pocket. Books or discs can be renewed by telephone, letter or personal call unless required by another reader. After library hours use the Ansafone Service (01-698 7347). For hours of opening and charges see notices at the above branch, but note that all lending departments close at 1 pm on Wednesday and all libraries are closed on Sundays, Good Friday, Christmas Day, Bank Holidays and Saturdays prior to Bank Holidays.

METROPOLITAN
SPECIAL COLLECTION

GUIDE TO BELFAST.

941 Gu

BELFAST, 1902.

A GUIDE TO BELFAST

AND THE

COUNTIES OF DOWN & ANTRIM.

PREPARED FOR THE

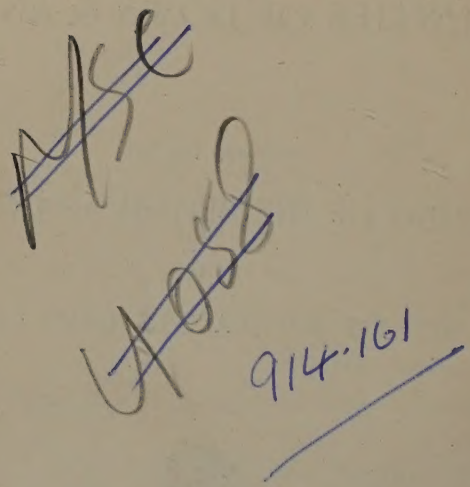
MEETING OF THE BRITISH ASSOCIATION

BY THE

BELFAST NATURALISTS' FIELD CLUB.

TRANSFERRED TO
Metropolitan Special Collections

Belfast:
M'CAW, STEVENSON & ORR, LIMITED,
THE LINENHALL PRESS.
1902.


914.161

PREFACE.

HEN the British Association met at Belfast in 1874, a Guide was prepared for the occasion by the Belfast Naturalists' Field Club, describing and illustrating the history, trade, agriculture, geology, botany, zoology, and archæology of Belfast and the adjacent counties of Down and Antrim. This work was the first of the "Handbooks" which are now considered an indispensable adjunct to the Association's meetings. The 1874 "Guide" long remained a standard work of reference on the district, and lately it has gone out of print.

The present "Guide" has the same origin as its predecessor, and follows the same general lines. It has been written by members of the Belfast Field Club, with the co-operation, in certain subjects, of fellow-workers outside the Club, whose assistance is gratefully acknowledged:—of Dr. R. F. Scharff, A. R. Nichols, G. H. Carpenter, and J. N. Halbert, all of the National Museum in Dublin, in the department of Zoology; and of H. J. Seymour, of H.M. Geological Survey, in the department of Geology.

The authorship of the various sections is as follows:—BELFAST, John Vinycomb and Alec Wilson; GEOLOGY, J. St. J. Phillips; BOTANY, Henry Hanna, R. Lloyd Praeger, and Rev. C. H. Waddell; ZOOLOGY, G. H. Carpenter, J. N. Halbert, Rev. W. F. Johnson, A. R. Nichols, H. Lamont Orr, Robert Patterson, R. Lloyd Praeger, R. F. Scharff, R. Welch, Joseph Wright; ANTIQUITIES, Francis Joseph Bigger and William J. Fennell.

The general editing of the "Guide" has been done by Francis Joseph Bigger, editor of the *Ulster Journal of Archæology*; R. Lloyd Praeger, editor of the *Irish Naturalist*; and John Vinycomb.

BELFAST,
September, 1902.

CONTENTS.

BELFAST—

Page.

History and Description 1–32
Trade and Commerce 33–56

GEOLOGY—

Physical Features — Stratigraphical Geology — Igneous Rocks 57–106

BOTANY—

Flowering Plants and Vascular Cryptogams—Mosses and Hepatics—Fungi—Algæ 106–148

ZOOLOGY—

Vertebrata — Mollusca — Arthropoda — Gephyrea — Chætopoda — Brachiopoda — Polyzoa — Rotifera — Nematoda — Nemertinea — Platyhelmia — Echinoderma — Cœlenterata — Porifera — Protozoa 148–242

ANTIQUITIES—

Prehistoric Remains—Carns and Cromleacs—Souterrains —Raths—Crannoges—Round Towers—Ancient Crosses —Sculptured Stones — Ancient Churches — Abbeys — Castles... 243–279

INDEX 281–283

BELFAST:

HISTORICAL AND DESCRIPTIVE.

By John Vinycomb, m.r.i.a.

Belfast Lough and Harbour.

The City of Belfast is situated at the extremity of Belfast Lough, formerly called Carrickfergus Bay, from the town and castle of that name, and at a period when Belfast was too insignificant a place to be noticed upon maps of the time. The lough is an arm of the sea, about twelve miles in length, the breadth at the entrance is about five miles, which decreases gradually towards the extremity where the river Lagan joins it at the city harbour, with its miles of quays and docks for foreign-going ships, iron shipbuilding and marine engineering works, etc., which here line both sides of the harbour.

On approaching Belfast by steamer, the stranger cannot fail to be struck with the picturesque beauty of the lough, the smiling villages scattered along its margin, and the hills rising behind on either side, running in a nearly parallel course from the entrance of the lough, and stretching far away up the valley of the Lagan. On the County Antrim side the most prominent of the hills near the city are Ben Madighan, now called Cave Hill (1,188 feet), with its bold precipitous cliffs and the great prehistoric fort of MacArt standing out in bold relief on its highest point; the Black

mountain (1,273 feet), with Divis (1,507 feet) rising behind it, and overlooking the city ; while the range of the Castlereagh hills appears on the southern or County Down side of the valley.

One of the first places of importance that meet the eye on entering the lough is CARRICKFERGUS CASTLE, the great military stronghold of the Anglo-Norman invasion, built by John de Courci in 1177, standing conspicuously on the

CARRICKFERGUS CASTLE.

northern shore. It still remains in perfect condition, notwithstanding the many sieges and captures it has undergone in troublous times ; it can only now be viewed as a picturesque relic, and quite useless as a place of defence. On the southern or County Down side, at the entrance of the lough, is the ancient monastic town of BANGOR, a favourite place of resort for summer visitors at the sea-side. Not far from Bangor is CLANDEBOYE, the ancestral home of the late MARQUESS OF DUFFERIN AND AVA ; upon the wooded hill behind stands HELEN'S TOWER, erected by Lord Dufferin in 1847, on his coming of age, as a token of love for his mother, Helen, Lady Dufferin. Tennyson and Browning, Haughton and Kipling, have, in immortal verse, made the tower for ever memorable. HOLYWOOD, a pleasant sea-side village of some 4,000 inhabitants, four miles from Belfast, on the road to Bangor, was also an ancient ecclesiastical seat of importance.

In 1613 the lough extended into what is now the heart of the city. Various extensions of the land have taken place from time to time, and where once the lonely heron waded undisturbed in the shallows of the lough, the harbour works have extended for miles into the sea, and the ceaseless din and hammering of the iron shipbuilding yards and engineering works fill the air. Hundreds of acres of land have been reclaimed from the lough on either side of the river, on which extensive ranges of warehouses and docks for the accommodation of foreign shipping have been constructed, and for the carrying on of the iron and steel shipbuilding, for which Belfast is now famous.

QUEEN'S BRIDGE.

A rambling old bridge of twenty-one arches formerly existed here, erected in 1689, over which Schomberg's heavy artillery, in passing in the same year, caused such damage, that three years later a large portion collapsed, and so remained until comparatively recent times. The present QUEEN'S BRIDGE was built in 1843. Anciently a ford existed at or near this place, from which the town takes its

name (BEL or BEAL, *a mouth, a ford, an entrance*, and FEARSAD, a sandbank).

THE RIVER LAGAN.—According to O'Donovan the Irish word Lagan signifies a hollow or narrow district between hills or mountains. The river takes its rise in Sliebh Croob (Slieve Croob), in the heart of County Down; its course beyond the city is now mainly a canal, and passes through some most charming scenery. It is a favourite haunt of artists and lovers of nature, the tow-path affording a delightful walk for many miles amid picturesque

SCENE ON THE RIVER LAGAN.

surroundings. The Lagan is a stream of no considerable size, but, with the deepening of the channel and the creation of the harbour, it has been utilized as a water-way into the interior of the country. The inland trade by water is carried on by the LAGAN NAVIGATION COMPANY, which connects the HARBOUR OF BELFAST with LOUGH NEAGH, and by the ULSTER CANAL, which connects LOUGH NEAGH with the UPPER and LOWER LOUGH ERNE.

Four bridges now span the river in its course through the city. From the Queen's Bridge, which joins the city proper with its populous suburb, BALLYMACARRETT (Bally MacArt), the town of MacArt [O'Neill]), there is a quay of two

miles for steamboats the whole length of DONEGALL QUAY, extensive docks and shipbuilding yards, beyond which there is a straight course out to the open sea. QUEEN'S QUAY on the County Down side is devoted to the discharging of coal steamers; beyond this are Abercorn Basin and Queen's Island Shipbuilding and Marine Engineering Works. An extensive reclamation of land is at present being made on the County Down side, and the formation of the new MUSGRAVE CHANNEL, which will very largely increase the accommodation of shipping interests.

HARBOUR OFFICE.

A daily service of steamers is carried on between Belfast and the principal cross-channel ports. There are also weekly, bi-weekly, and tri-weekly sailings to many other British ports, besides regular steamers trading to various foreign countries. Steam-ferries, which cross the harbour at different points, ply regularly during the day. A range of capacious sheds, for the protection of cargo waiting shipment or delivery, extends the entire length of the steamboat quays, and the different railway companies can bring their goods trains along the quays for direct shipment, or *vice versâ*, of goods in transit.

THE HARBOUR COMMISSIONERS (Sir James Musgrave, Chairman), who control and regulate all matters connected

with the Port and Harbour Trust, have their offices in a handsome and commodious building, situated near the Clarendon Dock.

The Custom House and Inland Revenue Office is a substantial building facing the quay, at the foot of High Street. On the esplanade in front are two forty-six pounder Russian guns from Sevastopol.

CUSTOM HOUSE.

The first great stimulus to the trade of the port was given by Lord-Deputy Wentworth in 1637, who purchased from the Corporation of Carrickfergus, then the chief town of Ulster, the right of importing certain commodities at one-third of the duties payable at other places.

HISTORY OF BELFAST.

"Belfast as a town has no ancient history," and does not lay claim to a remote origin like so many towns in Ireland. Its record is simply one of industrial progress, dating no farther back than the time of James I. In later times, however, it has been remarkable alike for its rapid growth in area and population, no less than for the commercial enterprise and intelligence of its citizens. As the capital of the Province of Ulster, and

the great manufacturing and commercial centre of Ireland, Belfast occupies the unique position of being the most progressive city in the country—possibly in the United Kingdom. In 1757 it contained only 1,779 houses, mostly straw-thatched, and a population of 8,549, which has gone on increasing until it amounts to 348,965, according to the census of 1901; the area of the town, however, having been largely increased so as to include all the suburbs. It is still considerably below Dublin, if that city had included within its area a proportionate amount of the surrounding districts. As it is, Belfast occupies the eighth place among the cities of the United Kingdom.

At the banquet given in Belfast to the late Lord Dufferin on his return from his last great diplomatic mission, his lordship said: "To a resident, the rate of progress which has taken place in Belfast during the last few years must have appeared very rapid; to one who, like myself, revisits the city after a considerable lapse of time, the change is simply marvellous; and well may we all be proud that a place which was of comparatively small account, and was certainly not a county town, should now rank as a great commercial city of the United Kingdom."

In 1600 Belfast boasted of but five streets, composed of thatched houses irregularly built and badly lighted, giving little indication of the size it was destined to attain in the present day. The few streets which formed the nucleus of the old town are fast disappearing under the march of city alterations; scarce one now remains of the quaint old houses of the days when the merchant lived over his place of business; wider streets are taking their place, with large buildings in all the leading thoroughfares. Vast areas are occupied by streets of workmen's dwellings in certain districts, while the residences of the merchants and gentry are mostly in the suburbs.

As to the early history of the town little can be said. The place is mentioned in the *Annals of the Four Masters* as the scene of a battle, in A.D. 660, between the Ulidians and Cruithni, which took place at the Ford or Fearsat, which was the name given to the place from the sandbank at the mouth of the little river which flows through Belfast, now

running underground — *Bel* or *Beul Fearsat* being the early name of the place. In 1177 John de Courci, an Anglo-Norman knight, held possession of the counties of Antrim and Down, and of what was the first CASTLE OF BELFAST of which there is any mention, and which he probably erected on an ancient site commanding the ford.

King John (1210) passed through Belfast on his way to Carrickfergus. It is impossible to trace the history of the place as a town till the reign of Edward II., at which period the Irish, galled by the oppression of the English, invited the Scots, under Edward Bruce (1316), brother of the Scottish king, to invade Ireland and expel the English. He hoped to found an independent monarchy by uniting all the Irish septs. Landing at Olderfleet, near Larne, with 6,000 men, and having been joined by the Irish chiefs, Bruce "fell with the fury of a devouring tempest upon the English settlements," and the town and castle of Belfast were destroyed. He was defeated and slain in a conflict near Dundalk by the English later on. Could he have realized his ambition, the later history of Ireland might have been very different.

The distraction consequent upon his defeat, and the subsequent murder of William de Burgo, Earl of Ulster, in 1333, by his own kinsman, at the Ford or Fearsat, did much to lessen the power of the Anglo-Normans; the Irish clans rose in arms, and, with the exception of the stout fortress of Carrickfergus, this portion of Ulster remained for a long period in the hands of the Irish.

In 1503 Gerald, Earl of Kildare, Lord-Deputy of Ireland, made an expedition into Ulster and destroyed the Castle of Belfast. Kildare made a second excursion into the north and again destroyed the castle, which had in the meantime been fully erected and re-occupied by the O'Neill. The castle seems to have been the scene of many a sanguinary encounter, being taken and retaken several times during this troublesome period.

The entire district was granted to the Earl of Essex, who was appointed Lord-Governor of the Province of Ulster by Queen Elizabeth in 1573. His chief camping-ground was at Belfast, which he proposed to make a fortified town and build a bridge over the river—schemes of which proved

abortive. Notwithstanding his high favour with the Queen, his expedition to Ireland was not successful: Essex displeased Elizabeth, and was recalled.

Sir Arthur Chichester, a Devonshire man, who had been appointed by the Earl of Essex Governor of Carrickfergus and the two Clannaboys, was made Lord-Deputy in 1604. He also received a grant of the town, manor, and castle of Belfast, and may truly be called the founder of the town. He was created, in 1612, Baron Chichester of Belfast. At this time the place was a mere village of a few scattered huts of about 500 inhabitants, on the margin of the lough, and clustering for protection near to the castle; the FORD, the CASTLE, and the CHURCH forming the three distinguishing features of the place which made the locality known in early times. Upon his advice Belfast was constituted a Corporation by charter of King James I., to consist of a *sovereign*, or chief magistrate, and twelve burgesses and commonalty, with the right of sending two members to the Irish parliament.

CASTLE PLACE, BELFAST, IN THE SEVENTEENTH CENTURY.

Sir Arthur Chichester, in 1611, built a castle upon or near the site occupied by the former castles, and which an old writer in 1635 describes as "a stately palace which is indeed the glory and beauty of the town." This, the last of the fortified

castles erected to hold and control the pass of the ford, was burned down, in 1708, through the carelessness of a servant, by which accident three daughters of Arthur, third Earl of Donegall, were burnt to death. The castle stood in the middle of an extensive garden, between what is now DONEGALL PLACE and CORN MARKET: many names in the vicinity, as Castle Street, Castle Place, etc., sufficiently indicate its proximity. Of this castle not a vestige now remains, the whole area of the castle, with its pleasure-grounds, being built over. Sir Arthur, the Lord-Deputy, died in 1625, and was succeeded by his brother, Lord Edward, afterwards Viscount Chichester, whose eldest son was created Earl of Donegall in 1647; and, subsequently, a descendant, Arthur, fifth Earl, was raised in 1791 to the dignity of Marquis of Donegall and Earl of Belfast.

BELFAST CASTLE.

The Chichester family, as lords of the soil, have been closely identified with Belfast and its interests all through its history. The mansion at Ormeau, on the east side of the river, was long the country residence of the family (now one of the public parks of the city, and well worthy of a visit). They had also a town house in Donegall Place, since demolished, and the site occupied by business premises. The third marquis built a magnificent residence (BELFAST CASTLE) on the south-eastern slope of Cave Hill. Upon

his decease in 1883 (his only son, the talented Earl of Belfast, having predeceased him in 1853), the title devolved upon his brother, Lord Edward Chichester. Belfast Castle was inherited by his daughter Harriet, the late Countess of Shaftesbury, along with the Irish estates, and now held by her son, the present Earl of Shaftesbury.

A word may be here added as to the elements that went to form the character of the people settled in the North of Ireland. In addition to the settlers brought over from Devonshire by Sir Arthur Chichester, the special inducements offered to needy Scottish adventurers induced large numbers to cross over to Ireland. The encouragement offered to settlers by the plantation scheme of King James proved a welcome refuge for the turbulent and sturdy "Border rievers," and also to many adventurers, who sought to push their fortunes where good land could be cheaply obtained on the confiscated estates. The grants by the Crown to the original "planters" were usually made on the express stipulation that a certain number of families out of England and Scotland should be planted on the lands. Belfast as a centre of commercial life dates from that period. Trade tokens were issued by merchants in lieu of current coin; ships purchased, dues exacted, and all the other mercantile pursuits actively engaged in of a young and vigorous community.

In the wars of 1641, the colonists were harried and stripped of everything by the Irish under O'Neill. It was only when William of Orange landed at Carrickfergus that anything like peaceful times were enjoyed by the people. The colonists received him with an outburst of enthusiasm and affection, which the lapse of two centuries has failed to diminish. Modern Belfast certainly owes very much of its reputation to the character and qualities of the Scottish settlers of King James's time, and the constant traffic they maintained with the neighbouring coast of Scotland. Much of the growth of later date is due to the influx of settlers from all parts of the United Kingdom attracted by its trade and prosperity; the combination of races has tended to produce a community not exceeded by that of any other part of the Empire for modern business aptitude: in fact,

Belfast has often been compared to an American city for its push and appearance. Friction sometimes does arise between sections of the rougher elements, as in other places. Let us charitably suppose that this may be only an indication of superabundant energy, which, with the spread of education and refinement, will by-and-by tone down into mutual esteem and good-will.

CHARTERS, INSIGNIA, &c.

ON the 27th April, 1613, Belfast, then a small town, was constituted a Corporation by charter of King James I., to consist of a sovereign* or chief magistrate, and twelve burgesses and commonalty, with the right of sending two members to parliament. This charter was annulled by King James II., and a new one issued in 1688, but the original one was restored in 1690 by William III.†

SILVER CORPORATE SEAL OF THE BOROUGH OF BELFAST, 1613.

In conformity with the passing of the Municipal Corporation Act of 1841, the constitution of the Corporation was changed, and made to consist of ten aldermen and thirty councillors, under the style and title of *The Mayor, Aldermen, and Burgesses of the Borough of Belfast.* The progress of the town meanwhile has been so great, that, in the jubilee year of her late Majesty, application was made that the Borough might be

* The word "sovereign" is now generally understood to be synonymous with "monarch." The original meaning, however, was not so restricted. The modern spelling is due to a false connection with *reign*. Milton writes "SOVRAN." The word comes from the Latin adjective *superans*—prevailing.

† This charter continued from 1613 to 1841 (over two centuries and a quarter), during which time the office of Sovereign was occupied by 120 gentlemen.

constituted a City. Accordingly a Royal Charter was issued in 1888 conferring the rank of a city upon Belfast, with all the "rank, liberties, privileges, and immunities" as are incident to a city.

In August 1890 a grant or confirmation of the arms so long borne by the town was obtained from Sir Bernard Burke, Ulster King of Arms, with a slight modification or augmentation of honour, to mark the accession to the rank of a city. A new town seal in accordance therewith was subsequently made, and is the one now in use.

In 1892 Her Majesty Queen Victoria conferred upon the Mayor of the city for the time being the style and title of "LORD MAYOR," and upon the Corporation of the city the name and description of "THE LORD MAYOR, ALDERMEN, AND CITIZENS OF THE CITY OF BELFAST," the Chief Magistrate, Sir Daniel Dixon, holding office at the time. He now again holds office as Lord Mayor (1901–1902).

CORPORATE SEAL OF THE CITY OF BELFAST, 1890. (REDUCED ONE-THIRD.)

By the passing of the Belfast Corporation Act of 1896, the boundary of the city was greatly extended, and the Corporation made to consist of fifteen aldermen and forty-five councillors, and the number of wards was increased from five to fifteen.

By virtue of the Local Government (Ireland) Act, 1898, Belfast became a County Borough 1st April, 1899, and for Assize purposes "The County of the City of Belfast," with a High Sheriff. The first High Sheriff appointed by the Lord Lieutenant was Alderman Sir James Henderson, M.A., B.L., J.P. *ex* Lord Mayor. The present High Sheriff is Alderman Samuel Lawther, J.P. A special chain and badge have been provided for the High Sheriff.

The original *Charters*, *Maces*, and other *Official Insignia* are carefully preserved by the Corporation. The two silver maces of the old borough—the smaller dating from 1639,

the other, which is seventeen inches in length—are also of the Stuart period.* Neither of them, however, is worthy of the city. With the opening of the new City Hall, it is to be hoped a new and handsome city mace will grace the proceedings. The gold chain of office worn by the sovereigns of the old borough was presented by the Earl of Donegall in 1787; the present, and more elaborate, chain of office dates from 1873–4. A chain, to be worn by the Lady Mayoress for the time being, was subscribed for by Members of the Council and Town Clerk, on 1st February, 1897: the then Lady Mayoress (Mrs. PIRRIE) was invested with it.

ROLL OF THE HONORARY BURGESSES OF THE CITY OF BELFAST.

(1) Alderman the Right Hon. W. J. Pirrie, P.C., elected 1st January, 1898.

(2) Thomas Henry Ismay, J.P., D.L., Dawpool, Thurstaston, Cheshire, elected 1st Feb., 1899; died 23rd November, 1899.

(3) The Most Hon. the Marquess of Londonderry, K.G., elected 1st March, 1900.

(4) The Most Hon. the Marquess of Dufferin and Ava, elected 1st March, 1900; died 12th February, 1902.

(5) General Sir George White, V.C., G.C.B., etc., elected 11th May, 1900.

(6) Field-Marshal the Right Hon. Earl Roberts, V.C., G.C.B., etc., elected 9th October, 1900.

---

* In the *Town Book of Belfast*, under date 1640, there is an entry authorizing the payment "For Maces, Armes, and the Towne Seale, for the Towne, 26 li."

MUNICIPAL INSTITUTIONS, &c.

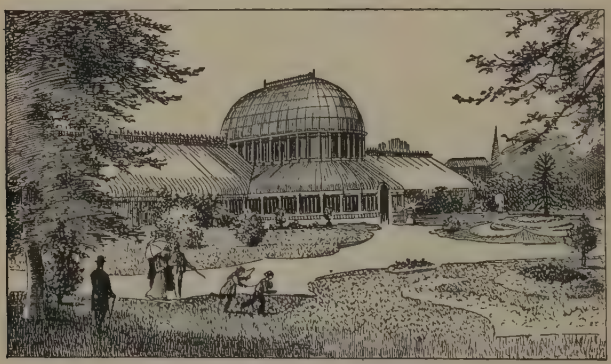
KEEPING pace with the civic changes already referred to, there have been formed at different periods THE BOARD OF THE BELFAST HARBOUR COMMISSIONERS, an elected body, who control great and important trusts (see page 5); THE BELFAST CITY AND DISTRICT WATER COMMISSIONERS, who control the WATER SUPPLY; THE CHAMBER OF COMMERCE, and various other public bodies and institutions, such as were rendered necessary by the ever-increasing requirements of the city.

PRESENT TOWN HALL.

The various departments of the municipality have their headquarters at the TOWN HALL in Victoria Street, not far from the Albert Memorial, while near at hand is the chief FIRE STATION, erected in 1893 (it is also the station of the AMBULANCE CORPS), one of the most complete from every point of view in the United Kingdom; while sub-stations and alarm stations are placed in various parts of the city, and in telephonic communication with the head office. It is admitted on all hands that the members of the Fire Brigade are excelled by none in promptitude and daring. The RECORDER'S COURT and POLICE COURTS are situated

immediately behind the present Town Hall. The ROYAL IRISH CONSTABULARY, who are the guardians of the peace of the city, have a large and commodious barrack adjacent. The nominal strength of the force in Belfast, sergeants and constables, on 31st January, 1901, was 933, at an actual cost to the city (1900) of £16,732 2s. 2d. The GAS AND ELECTRIC LIGHTING of the city is under the control of a Committee of the Corporation.

While attending to the material interests of the citizens, the Corporation have not been unmindful of the health and pleasurable recreations of the people. There are seven PUBLIC PARKS. With the exception of Victoria Park, reclaimed from the lough, they are all tastefully laid out and planted,



THE PALM HOUSE, BOTANIC GARDENS PARK.

and kept in excellent condition. ORMEAU PARK, of 100 acres, the old seat of the Marquis of Donegall, is a charming place, full of well-grown timber and laid-out flower gardens; FALLS PARK (44 acres), which adjoins the City Cemetery, is on the slope near the foot of the Black mountain; BOTANIC GARDENS PARK (14 acres), adjoining the Queen's College, has a fine palm-house, fernery, orchid, and plant-houses. Tram-cars go from the central junction (Castle Place) to all the parks: the tram officials will direct visitors. The other parks are—ALEXANDRA (10 acres), WOODVALE (24 acres), and DUNVILLE (4½ acres). The Dunville Park

was presented to the city; the others were acquired at the cost of the citizens.

BATHS, WASH-HOUSES, and LODGING-HOUSES are established and conducted in various parts of the city under a Committee of the Corporation, as are also the FREE PUBLIC LIBRARY, ART GALLERY, AND MUSEUM, which are situated in Royal Avenue.

The beautifully situated and tastefully laid-out CITY CEMETERY, Falls Road, is another of the many departments managed by the City Council. The various committees, which meet regularly at stated times for the transaction of business, are—POLICE, CEMETERY AND PARKS, ASYLUM, MARKETS, IMPROVEMENT, PUBLIC HEALTH, FINANCE, LAW, LIBRARY AND TECHNICAL INSTRUCTION; BATHS, WASH-HOUSES, AND LODGINGS; GENERAL PURPOSES, and several of special or lesser importance.

STATISTICS.

	A.	R.	P.
The area within the municipal boundary is	16,503	3	26

The valuation of the city for municipal purposes was—

In 1841	£135,000
,, 1871	460,802
,, 1891	1,160,051

Corporation redeemable stock outstanding ... £1,608,030

Population of the city (1901) 348,965

Parliamentary voters in the four divisions:

NORTH.	SOUTH.	WEST.	EAST.
12,388	13,669	10,961	18,903

City Taxation:

Houses under £20	...	4/5 in the £1.
Houses over £20	...	5/– ,,
Poor Rate		1/– ,,

Rate per 1,000, based on estimated population of 359,000: Births, 32.1; Deaths from all causes, 21.3; Zymotic diseases, 2.1.

The County Borough of Belfast returns four members to the Imperial Parliament.

THE STREETS AND CHIEF PUBLIC BUILDINGS.

Of the numerous public buildings, none are of early date or possess any interest for the antiquary. The city is notable more particularly for its spacious well-kept streets, and the buildings, at once substantial and handsome; some of the newer business thoroughfares, as Royal Avenue, are particularly fine. The NEW CITY HALL, however, promises to be the centre of the city. The extensive

NEW CITY HALL (IN COURSE OF ERECTION, 1902).

business house of ROBINSON & CLEAVER, one of the show-places of the city, at the corner of Donegall Place; that of RICHARDSON, SONS & OWDEN, facing the City Hall; the large range of buildings erected by the SCOTTISH PROVIDENT SOCIETY, and the Y.M.C.A. BUILDINGS, already give the lead to others in course of erection, or in anticipation, in the neighbourhood of Donegall Square; while the NEW TECHNICAL INSTITUTE, on the grounds of the Royal Academical Institution, and the NEW PRESBYTERIAN ASSEMBLY HALL, now in course of erection, will still further contribute striking important buildings in the leading streets.

Belfast has its wants fairly well supplied with public buildings of various kinds—churches, colleges, educational and other institutions, hospitals, banks, hotels, clubs, etc.;

while new districts are being opened up, where lengthening streets of private houses keep in line with the ever-increasing population.

HOW BEST TO SEE THE CITY.

Some of the Principal Buildings, &c.

For the purpose of viewing the city, no better plan can be adopted by the stranger than by taking the tram-lines as the routes to be followed. From Castle Junction—the centre of the tramway system, and in the very heart of the city—excursions can be made in various directions. From the top of a tram-car an excellent view is obtained, and a few hours may be profitably and pleasantly spent in this way in getting a general view of the streets and suburbs.

The most notable monument in Belfast is the Albert Memorial Clock Tower at the foot of High Street, close to the steamboat quays and the Custom House. Only two other monuments at present stand in our public streets—statues of eminent local divines: Dr. Cooke, opposite the Royal Academical Institution, and Dr. Hanna, at Carlisle Circus. A very handsome Statue of Her late Majesty, in commemoration of her Diamond Jubilee, has been executed, and will be placed in front of the New City Hall facing Donegall Place. Beside it, one of Sir Edward Harland, the founder of the Shipbuilding Works, is ready for erection. Funds

ALBERT MEMORIAL.

have also been subscribed on a liberal scale for a great statue in memory of the late Lord Dufferin. The beautiful statue of the Earl of Belfast, by Patrick MacDowell, which formerly stood on the site of Dr. Cooke's statue, is now in the Free Library.

Reference may be briefly made to some of the leading thoroughfares. Standing in Castle Place, opposite the "BANK BUILDINGS," the eye wanders to the right along ROYAL AVENUE, a wide and well built street, which may now be

ROYAL AVENUE.

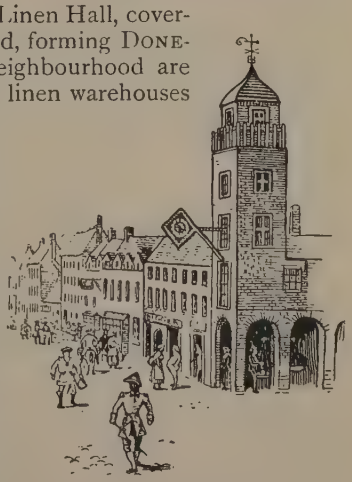
considered the principal thoroughfare of the city, joining, as it does, several important outlying parts of the town to the centre. The buildings close at hand are the PROVINCIAL BANK, and next to it the REFORM CLUB; farther on, the GRAND CENTRAL HOTEL; and on the opposite side, the ROYAL AVENUE HOTEL and the offices of the CITY AND DISTRICT WATER COMMISSIONERS, a handsome building of red sandstone. The GENERAL POST OFFICE and the FREE PUBLIC LIBRARY, Art Gallery, and Museum are also situated in this street.

Turning to the left hand is DONEGALL PLACE, on a line with Royal Avenue; it also has some very fine places of business, with Robinson & Cleaver's at the opposite end. This

DONEGALL PLACE.

important street leads direct to the NEW CITY HALL, which occupies the site of the old Linen Hall, covering about five acres of ground, forming DONEGALL SQUARE. In this neighbourhood are situated most of the great linen warehouses and town offices of the linen manufacturers.

Looking down Castle Place, the eye is attracted to the large building on the left —the ULSTER CLUB—the city rendezvous of country gentlemen and wealthy business men. Directly opposite, on the right, where the line of shops now stands, was the site of the castle and pleasure gardens of the great Lord-Deputy, Lord Arthur



OLD MARKET HOUSE.

Chichester, referred to on page 9. The entrance to the castle was at the corner of Corn Market. Directly facing the entrance, on the site of Forster Green's premises, stood the OLD MARKET HOUSE, the centre of corporate life of the town for many a long day.

Looking from Corn Market down High Street towards the river, the ALBERT MEMORIAL meets the gaze. This is one of the oldest (and the principal) streets of old Belfast.

HIGH STREET.

The little river Farset ran down the middle of the street between green banks in the old days: it is now, happily, underground. At Bridge Street, a stone bridge crossed the stream; hence the name. Many fine shops grace this thoroughfare. Following the tram-line along Bridge Street to Donegall Street, we come upon the magnificent Cathedral, now being built on the site of the old parish church of Saint Anne. (See illustration on next page.)

The illustration shows the design, by Sir Thomas Drew, P.R.H.A., for the Cathedral. At present only the nave and aisles are being built. The design as a whole must await, for its realization, a time when larger funds are available. The first section, the completion of which is expected in about a year from the present time, will however provide

a large church which can be used for all cathedral purposes, and which will hold a congregation of nearly 2,000 people.

Architecturally, the Cathedral will mark an interesting departure from custom. The traditional Gothic type has been abandoned, as it was found that a vast outlay would have been necessary in order to provide a Gothic cathedral of noble design, and at the same time large enough to meet the needs of the overflowing population of a modern city.

THE NEW CATHEDRAL OF BELFAST (WHEN COMPLETED).

(From a Drawing by Sir Thomas Drew.)

Belfast Cathedral is to be Basilican in its general type. This primitive model has been found to be far more easily adapted to modern congregational purposes than the mediæval type, and to be far less costly in proportion to the accommodation provided.

Sir Thomas Drew writes: "The new Cathedral will have a forty-foot nave. The disposition of its parts will be broader and simpler, with fewer arches springing over wider

spans, than in a typical Gothic church. . . . The plan and proportion of the church are singularly simple and arithmetical. A nave of 40 feet, aisles of 20 feet width, six bays of the nave, each of 20 feet; the crossing, transepts, and chancel, each within their piers, square of 40 feet; the internal height of the aisle walls 36 feet, and of the walls of the nave and its clerestory, 72 feet. . . . The whole length internally when complete will be 214 feet.

"For what is known as architectural 'style,' the architect has had to adapt his design to what seemed to him harmonious with a Basilican plan. . . . He has adopted a round-arched treatment, the main suggestion of which comes from that Byzantine source which impressed itself on the early church architecture that came through Italy by way of the South of France to England and Ireland, and gave us in these countries such noble round arched architecture as may be seen at Cashel or Durham or Tuam. The striking 'Romanesque' architecture of southern France presents, perhaps, the purest type of a noble architecture which is suggestive to an architect and consonant with the Basilican plan."

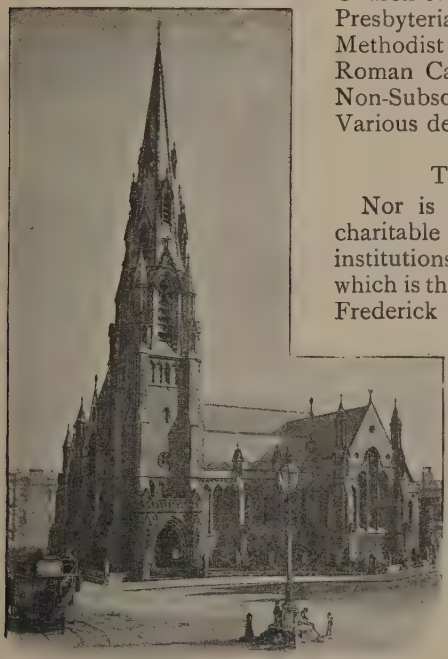
When complete, the Cathedral will be a very large and impressive building. The nave and its turrets will rise 105 feet above the pavement of Donegall Street. The summit of the central tower will be 175 feet above the same level. The great central portal of double doors will form a very striking and beautiful feature. It is on the same scale as the west portal of the Cathedral of Genoa. The entire building will hold a congregation of 4,000.

The beginning of this great work was due to the energy and enthusiasm of the first Dean of Belfast (the present Bishop of Cashel) and the generosity of the late Countess of Shaftesbury. The foundation-stone was laid by the present Countess of Shaftesbury on 6 September, 1899.

The first section, which is now in process of building, will cost £30,000. Of this amount, £25,000 has been already subscribed. The remaining £5,000 is urgently required. The rest of the design will be realized, in sections, when funds are available for the purpose.

CHURCHES, &c., WITHIN THE CITY.

BELFAST may be said to be fairly well supplied with places of worship; some of them are of considerable architectural beauty, but most are plain and unarchitectural.



CARLISLE MEMORIAL METHODIST CHURCH.

Church of Ireland	38
Presbyterian	55
Methodist	33
Roman Catholic.....	18
Non-Subscribing.....	5
Various denominations	20
Total.....	169

Nor is Belfast wanting in charitable and benevolent institutions, chiefest among which is the ROYAL HOSPITAL, Frederick Street.

During the year 1897 an important project was undertaken, with a view of marking the Diamond Jubilee of the Queen, of raising £100,000 for the purpose of building a new hospital. Mrs. Pirrie, the Lady Mayoress, entered very warmly into the project, and, largely owing to her untiring energy, the entire sum was subscribed. The institution, which will bear the name of the "ROYAL VICTORIA HOSPITAL," is being built on finely situated grounds on Grosvenor Road. Efforts are being made to secure an adequate endowment fund. THE MATER INFIRMORUM HOSPITAL, Crumlin Road, a

similar institution for the relief of the sick and suffering, was erected under the auspices of the Roman Catholic body, and placed under the care of the Sisters of Mercy. The total outlay for building and equipping the hospital was about £50,000. There are also various other hospitals for the treatment of special diseases, all of which are doing good work.

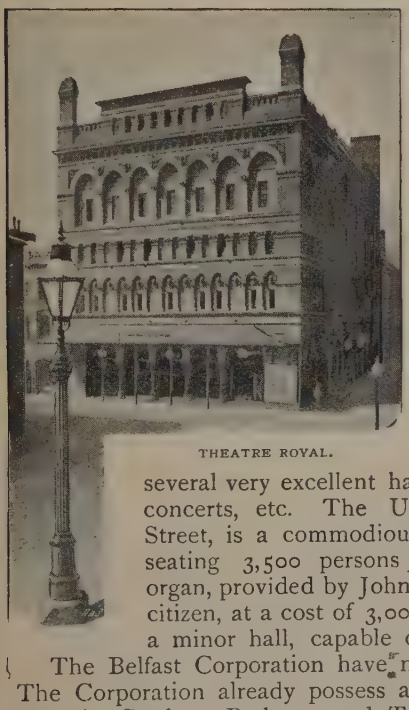
The BELFAST CHARITABLE SOCIETY is the oldest charity in Belfast, having been opened for the admission of the sick in 1752. Since the coming into operation of the Irish Poor-Law Act, the charity has been in its practical operations limited to the class of decayed citizens, reduced tradesmen, artisans, and servants; the admission being by election. The institution is supported by voluntary contributions, and by the rental of certain grounds and houses which have been erected on the land contained in the original grant. The charitable and benevolent institutions in the city are numerous and well supported.

COUNTY ANTRIM COURT HOUSE, Crumlin Road, a handsome structure with stone portico. It comprises two commodious courts, the Crown and Record, with adjoining rooms for the barristers and solicitors engaged, and accommodation for the Grand Jury, the County Council, and County officers. On the opposite side of the road is the COUNTY JAIL: an underground passage connects the two buildings.

The MILITARY BARRACKS, North Queen Street, among the finest and most commodious in Ireland. New barracks were, a few years ago, erected in Holywood, upon an admirable site, known as the Bishop's Palace Grounds, adjacent to which, on the shore of the lough, is the Kinnegar Rifle Range, leased by the Government.

The SOLDIERS' HOME, in Clifton Street, a handsome and commodious building, opened in 1891, has contributed in no small degree to the welfare of the troops located in the Belfast garrison.

PLACES OF AMUSEMENT AND PUBLIC HALLS.



THEATRE ROYAL.

THE THEATRE ROYAL, in Arthur Square, is a fine building, with all the usual arrangements; the same may be said of the OPERA HOUSE, in Great Victoria Street: both theatres are owned by a limited liability company. The EMPIRE MUSIC HALL and the ALHAMBRA MUSIC HALL are devoted to variety entertainments.

Belfast possesses several very excellent halls for public meetings, concerts, etc. The ULSTER HALL, Bedford Street, is a commodious structure, capable of seating 3,500 persons; it contains a grand organ, provided by John Mulholland, a wealthy citizen, at a cost of 3,000 guineas; there is also a minor hall, capable of seating 400 persons. The Belfast Corporation have now purchased the hall. The Corporation already possess a capacious hall in the Botanic Gardens Park, termed THE EXHIBITION HALL, where many important meetings and receptions are held. The SAINT MARY'S HALL, close to the Bank Buildings, is also capable of seating a large audience. The GROSVENOR HALL is a light, commodious structure, capable of holding a large audience, and is mostly used for popular religious services. There are also a number of other halls in the city for meetings and concerts by the citizens of Belfast.

The city is not wanting in opportunities for the enjoyment of the various forms of athletic SPORTS, such as cricket, football, lacrosse, lawn tennis, golf, hockey, and bowling.

There are also two clubs for the encouragement of aquatic amusements—the BELFAST BOAT CLUB and the COMMERCIAL BOATING CLUB. The ROYAL ULSTER YACHT CLUB has its club-house at Bangor, Co. Down. There are also several successful SWIMMING CLUBS in the city.

COLLEGES, EDUCATIONAL INSTITUTIONS, &c.

THE QUEEN'S COLLEGE is a stately edifice in the Tudor-Gothic style of architecture; finely situated in its own grounds of eleven acres, at the west end—the most beautiful building in the city.

QUEEN'S COLLEGE.

This college, which has sister institutions in Cork and Galway, originally formed the QUEEN'S UNIVERSITY. The distinguished *alumni* are to be found in all parts of the world. In the ROYAL UNIVERSITY OF IRELAND, which took its place, the Belfast Queen's College continues to hold the premier place.

On Saturday, 11th August, 1849, QUEEN VICTORIA and PRINCE ALBERT visited the college previous to its opening at the latter end of the same year. Adjoining the college grounds is the BOTANIC GARDENS PARK, one of the most beautiful of the public parks.

The PRESBYTERIAN COLLEGE, a handsome block of stone buildings in the classic style, which stands a short distance from Queen's College, was opened in 1853. This college, with Magee College, Derry, now grants theological degrees in connection with the General Assembly of the Presbyterian Church in Ireland.

The ROYAL ACADEMICAL INSTITUTION, College Square, founded in 1807 (opened in 1810), at a cost of £30,000, raised by public subscription. Many eminent scholars and statesmen received their early training in this great public institution. The new Technical Institute will be built upon portion of the grounds in front.

BELFAST ROYAL ACADEMY, Cliftonville, originally founded in 1785 as "The Belfast Academy." In 1876 the present beautiful building was erected on the outskirts of the city.

METHODIST COLLEGE.

The METHODIST COLLEGE (opened in 1868) comprises an extensive range of buildings of considerable architectural beauty; is in close proximity to Queen's College. It is used as a Theological Training School for candidates for the ministry of the Methodist Society in Ireland, and as a high-class public school for boys and girls.

The CAMPBELL COLLEGE (opened in 1894) is situated in the beautiful demesne of Belmont, at the terminus of one of the tramway lines on the County Down side, 3½ miles from Castle Junction. It was founded in accordance with the will of the late H. J. Campbell of Craigavad, County Down, who left a legacy of about £200,000 for the building and endowment of a high-class public school.

CAMPBELL COLLEGE.

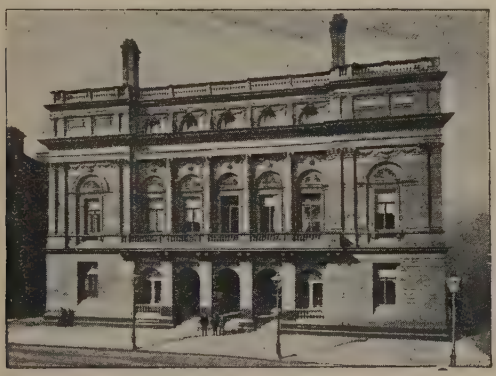
VICTORIA COLLEGE, The Crescent (founded in 1859 by Mrs. Byers for the education of girls), has had a most successful career in the higher education of women.

ST. MALACHY'S DIOCESAN COLLEGE, at Vicinage, a short distance from Carlisle Circus. This Roman Catholic College provides education for boys in all branches of study.

There are numerous educational establishments of a high class in or near the city, of which the foregoing are the principal.

Of public institutions of an educational character may be briefly mentioned the FREE PUBLIC LIBRARY, ART GALLERY, AND MUSEUM, Royal Avenue (opened in 1888); is one of the finest buildings in Belfast. Besides the lending and reference departments, it contains a good collection of antiquities and natural history objects, presented to the city by the late Canon Grainger. A bronze statue of the Earl of Belfast, by MacDowell, a native of the city (who executed the figures of William Pitt, Lord Chatham, and Viscount Exmouth, in St. Stephen's Hall, Westminster, and one of

the groups at the Albert Memorial, Hyde Park), adorns the large hall of the reference library. The Library and Technical Committee of the Corporation also conduct, under the Agricultural and Technical Education Act, a SCHOOL OF ART, and a number of technical classes in temporary premises in various parts of the city.



FREE PUBLIC LIBRARY.

The MUSEUM OF THE NATURAL HISTORY AND PHILOSOPHICAL SOCIETY, College Square North (founded in 1821), contains a good collection of objects. The antiquity-room contains a large series of examples, mainly from the North of Ireland, gathered by the late George Benn. Local archæology is illustrated by collections contributed by many other antiquarian students. The museum embraces an excellent series of the departments of geology, zoology, and botany. The BELFAST NATURALISTS' FIELD CLUB, now in its fortieth year, holds its winter meetings in the museum. The LINEN HALL LIBRARY, Donegall Square, or, more accurately speaking, the Belfast Society for Promoting Knowledge, was established in 1788. Until recently the library was kept, and the meetings of the society were held, in the central building of the Linen Hall; hence the name which it has so long borne. Since

the purchase of the Linen Hall site by the Corporation, the library has been removed to a spacious building close by. Among its literary treasures it contains the GIBSON COLLECTION OF BURNS AND BURNSIANA, a unique collection of over one thousand volumes.

WORKING MEN'S INSTITUTE AND TEMPERANCE HALL, a commodious building at the corner of Castle Street and Queen Street; contains a news-room, an amusement-room and library, and also a large lecture and concert hall. The institute was founded in 1873, and was inaugurated by Lord Dufferin. Science and technical classes, under the auspices of the Corporation, are held here.

The YOUNG MEN'S CHRISTIAN ASSOCIATION, Wellington Place, possess a splendidly-equipped building, with class-rooms, gymnasiums, and lecture halls, with appointments of the most complete kind in every way, capable of doing excellent work.

The BELFAST ART SOCIETY, established in 1880, has a suite of rooms at 49, Queen Street, and holds its annual exhibitions in the galleries of the Public Library in the autumn of each year.

MUSIC.—There are several musical societies, the principal of which are the PHILHARMONIC SOCIETY, Belfast City Choral Society, the Ladies' Cecilian Choir, Dr. Price's Male Choir, etc.

There are also societies devoted to literary, medical, and scientific subjects, which it is needless to enumerate.

BELFAST:
ITS TRADE AND COMMERCE.

By Alec Wilson.

The rise of Belfast into its present position as the "Commercial Capital" of Ireland has been so rapid and remarkable, that it deserves to be again emphasized, though it has been already mentioned in the preceding article. A century ago, Belfast was hardly more than a village at the end of a tidal estuary, navigable only by vessels up to 300 tons, which had to work slowly along a difficult stream between banks of "slob." There were many ports which looked more suitable for a considerable over-seas traffic; and, in fact, it was not until the advance of mechanical knowledge had produced the power-loom and the dredger that Belfast's real history began. It then became evident that the central position in which the city stands as regards the North of Ireland had marked it out as the depôt for Ulster; but the business aptitude of Belfastmen took their trade far beyond the comparatively small duties of supplying their own neighbourhood; and to-day, the linen, ships, ropes, tobacco, and many other products of Belfast are famous the world over.

Since 1841 a straight channel has been cut for a length of four miles, a work of great importance, giving a waterway of 300 feet wide, with a present depth of 28 feet at high water. There are a large number of steam cranes, lifting from 2 to 100 tons, the latter being erected alongside the Alexandra Dock. This dock is 825 feet long and 85 feet wide at the entrance; it is thus among the largest in the Kingdom; but a still larger one is projected. The present area of the docks and basins is about 136 acres, and considerable extensions are in contemplation, to give proper accommodation to the many traders who find the existing quayage too congested for their requirements.

The Belfast Harbour Commissioners are spending large sums of money in improving the harbour and docks.

The Musgrave Channel, which will run from the north end of the East Twin Island, constitutes practically a duplication of the Victoria Channel, and will be about $1\frac{1}{2}$ mile

long and 300 feet wide at the bottom, with a depth of 17 feet at low water. This depth can be increased at will, as the trade demands.

Three large wooden jetties are being constructed in this channel for the convenience of the shipbuilding trade, and the provision of these jetties is expected to considerably relieve the congestion in the main harbour.

Parliamentary powers have been procured for the construction of a large tidal dock of 14 acres at the south end of the Musgrave Channel, as well as of a graving dock, which, when built, will be the largest and most complete in the world, and it is expected that work will shortly be commenced on one or both of these undertakings.

Sufficient has been said to demonstrate that the Belfast Harbour Commissioners are fully alive to the importance of keeping pace with the times.

The revenues collected by the Customs authorities now approach £3,000,000, being the third largest in amount of the ports in the United Kingdom, and only exceeded by London and Liverpool. The following tables illustrate the growth of the shipping trade of Belfast:

	Tonnage registered at the Port.		Tonnage cleared from the Port.	
Year.	Vessels.	Tonnage.	Vessels.	Tonnage.
1840	355	45,632	3,323	361,473
1850	463	74,770	4,490	624,113
1860	508	74,049	6,658	885,413
1870	462	62,653	8,303	1,616,908
1880	399	76,386	7,965	1,225,566
1890	293	125,632	8,050	1,840,666
1900	210	147,575	8,318	2,325,936

The Corporation of Belfast have for some time adopted the policy of taking over, when possible, the various public services under their own management. One of the most important of these is the GAS-WORKS; and the enterprising way in which these have been managed will be obvious to anyone who visits the magnificent range of buildings on the Ormeau Road. During the last twenty-five years the consumption of gas increased so rapidly that the congestion in the works became very great; the remedy adopted was the erection of plant for the manufacture of carburetted water-gas. This has proved a most satisfactory means of

cheapening the gas as well as of producing it in large quantities; no less than a million cubic feet per hour being delivered during the busiest time of the evening. To cope with this output, the six gas-holders are, of course, of large size, the largest of them containing over $2\frac{1}{2}$ million cubic feet. The cost to the consumer is on a sliding scale, ranging up to 2/3 per 1,000 cubic feet.

The Corporation are now organizing a TECHNICAL INSTITUTE, which deserves a short description.

The city has a grant of £10,000 a year, in aid of technical instruction, from the new Department of Agriculture and Technical Instruction. This sum is administered by the Library and Technical Instruction Committee of the Corporation. In 1900 it was decided to build a Technical Institute, and a site was secured having an area of some 5,450 square yards. Plans were prepared, and a Principal appointed. After careful inquiry, it was considered that the proposals were inadequate for the prospective needs of the city, and the plans were accordingly enlarged. Tenders have now been accepted for the erection of the building, the contract price being £81,000. The building will be completed about the year 1905. In order to avoid duplication of classes, the committee held a number of conferences during 1901 with the various schools then providing evening instruction in Science, Art, and Technology, resulting in these bodies handing over their work to the city. This has enabled the Institute to formulate a homogeneous scheme of instruction, to secure an efficient organization, and to provide against waste of funds or of teaching energy.

The first evening session opened on the 30th September, 1901. That the efforts of the committee have met with a gratifying response is shown by the fact that the number of tickets issued up to date (May 1902) for the various courses of instruction is 4,290: in addition, 5,220 tickets have been issued for single lectures. The work is spread over a large area, there being, in addition to the four central buildings, six branches in outlying parts of the city. There is a staff of about 100 teachers and assistants.

It is to be hoped that the Corporation will, before long, get the TRAMWAYS under their control, as until then there

seems no chance of establishing any form of mechanical traction, and the city has to put up with the now antiquated horse-tram.

The following tables are extracted from the Report of the Belfast Harbour Commissioners for 1901, but it is to be noted that 1901 was a year of general depression, and that many of the figures are consequently lower than usual :

IMPORTS.

Ale and Beer	6,111 tons.
Anchors, etc.	1,185 ,,
Barley (raw)	19,620 ,,
Bleaching Powder	2,800 ,,
Bottles	6,134 ,,
Bran	26,546 ,,
Cement	23,656 ,,
Coal	1,164,641 ,,
Coke	6,219 ,,
Cotton Goods	12,010 ,,
Deals	34,905 loads
Dyestuffs	1,801 tons.
Fish	2 616 ,,
Flax	21,716 ,,
Flaxseed	1,640 ,,
Flooring Boards	17,415 loads
Flour	106,100 tons.
Grains	8,634 ,,
Hemp	11,442 ,,
Indian Corn	202,786 ,,
Iron (cast and wrought)	54,202 ,,
Lard	2,731 ,,
Linseed Cake	8,896 ,,
Machinery	7,159 ,,
Oil (Petroleum and Paraffin)	33,298 ,,
Onions	5,690 ,,
Paper	7,792 ,,
Phosphates	8,645 ,,
Porter	11,084 ,,
Rivets	3,432 ,,
Rosin	4,153 ,,
Rye	14,796 ,,
Sacks, etc.	2,773 ,,
Seed (Grass, etc.)	2,260 ,,
Sheep	16,560
Shoes	2,410 ,,
Slates and Slabs	6,888 ,,
Soda (Crystals, etc.)	8,081 ,,
Spokes	20,350

Steel	63,534 tons.
Stone (paving and building)	24,463 ,,
Tiles	9,772 ,,
Wheat	12,996 ,,

EXPORTS.

Aerated Waters	9,721 tons.
Apples and Pears	1,153 ,,
Bacon	9,382 ,,
Butter	3,261 ,,
Candles	550 ,,
Cattle	109,613
Coal	11,588 ,,
Cordage	6,297 ,,
Cotton Goods	5,495 ,,
,, (raw)	23,028 ,,
Eggs	12,254 ,,
Felt	13,868 ,,
Fowl	2,821 ,,
Hams	2,585 ,,
Hay and Straw	16,359 ,,
Hides and Skins	2,078 ,,
Horses, Mules, and Asses	7,771
Indian Corn and Meal	32,671 ,,
Iron Ore	41,964 ,,
Iron (scrap)	16,100 ,,
Lard	3,558 ,,
Linen	40,609 ,,
Machinery	6,078 ,,
Manure (artificial)	9,721 ,,
Meal, etc.	8,735 ,,
Meat	2,007 ,,
Mussels	1,436 ,,
Oats	2,427 ,,
Oil (Petroleum and Paraffin)	14,202 ,,
Pigs	70,602
Pork	1,195 ,,
Potatoes	25,958 ,,
Rags	1,335 ,,
Ropes	2,616 ,,
Salt (crushed)	4,622 ,,
Sand (moulding)	10,717 ,,
Seed (Grass, etc.)	15,394 ,,
Sheep	31,385
Thread	1,056 ,,
Tobacco	2,493 ,,
Whiskey	29,586 ,,
Yarn (Linen)	7,973 ,,
Yeast	2,630 ,,

TRADES AND INDUSTRIES OF THE CITY.

In the limited space at our disposal, it is obviously impossible to go fully into the details of every industry carried on in the North of Ireland, and it has been thought better to select a few representative firms, and describe them somewhat better than would otherwise have been possible. *Ab uno disce omnes.* There are many firms whose factories and workshops are fully equal to those described here, but which have had to be omitted, either on the score of space or to avoid reduplication, and to prevent this account from becoming a mere list of names: it is therefore necessary to apologize to very many firms of the first repute, whose names have been left out as the result of adopting this method of illustrating our commerce. And here the compiler must offer his best thanks to the various firms who most kindly supplied the information upon which this article is based; also to the principal of the Technical Institute (Mr. F. C. Forth), to the Belfast Harbour Commissioners, and to the proprietors of the *Belfast Directory* for their kind permission to use their valuable statistics and information. We may now proceed to a brief account of the LINEN TRADE, the greatest of Ulster industries.

Linen and other textiles have for centuries formed a mainstay of Ulster; for so early as A.D. 1216 we find it stated by Macpherson that the linen manufacture was then in a flourishing condition, and in 1245 De Burgo, Earl of Ulster, had large parcels of linen woven for him at Ballylisnevan, now called Newtownards. Woollens, again, in the reign of Charles I. were exported to the value of £110,000 annually. Protection laws in England ruined this latter trade, but linen-weaving was revived on a large scale by the Huguenots after the Revocation of the Edict of Nantes. The real founder of the present great industry was one Crommelin, who settled at Lisburn in 1619, together with a few other men, who were induced to do so largely by the advantages offered by William III.

In 1711 a Board of Trustees was appointed to supervise and encourage Irish flax and hempen manufactures, who exercised a large influence on the trade for more than a

century; among their duties were the examining and stamping of every piece of linen offered for sale, and also the granting of bounties and prevention of fraud. They kept a detailed record of the exports of linen and linen yarn. The following is taken partly from their tables:

YEAR.	EXPORTED.	YEAR.	EXPORTED.
1690 ...	300,000 yds. plain linen	1780 ...	18,746,902 yds. plain linen
1720 ...	2,400,000 ,, ,,	1810 ...	37,061,859 ,, ,,
1750 ...	11,200,000 ,, ,,	1820 ...	37,464,279 ,, ,,

About the year 1828 mechanical methods began to be adopted, and the whole system was thereby remodelled, as will be evident from the fact that one girl can now attend to about 160 spindles, each producing daily twice the amount formerly spun by hand on a wheel. Next to the invention of machinery, the linen trade received its greatest impetus from the American Civil War, which destroyed the manufacture of cotton in the States, resulting in a boom in linen, which laid the foundation of several great fortunes; but the reaction was severe, affecting the linen merchants of Ulster for many years. During the last ten years there has been but little expansion, and, no doubt, the competition of cheap foreign goods has made itself felt. A curious feature of the linen trade is that so few of the firms engaged in it carry on more than one or two of the operations necessary for the production of the finished web. The most important of these processes are as follows: scutching, spinning, weaving, beetling, and bleaching Several of the larger establishments, however, have every part of the manufacture of their linen under their own control. The following figures illustrate the more recent history of our staple industry:

	Spinning Mills.			Power-loom Factories.
Year.	Spindles Employed.	Spindles Unemployed.	Total Spindles.	Total Looms.
1883	816,334	58,454	874,788	21,779
1885	810,456	63,454	873,910	24,300
1887	803,026	40,564	843,590	25,300
1889	827,451	7,456	830,907	26,360
1891	827,451	—	827,451	26,592
1893	837,642	9,000	846,642	28,233
1895	846,642	—	846,642	28,764
1897	869,056	—	869,056	31,484
1899	835,100	—	835,100	31,484
1901	830,700	—	830,700	31,484

Having thus sketched the history of the Linen trade, a short description of a representative mill may be given. The York Street Flax Spinning Co.'s concern is one of the largest and best-equipped of flax mills, and is one of the "sights" of Belfast; it is also the oldest of its kind, having been started in 1830. Since the foundation of the present company in 1864, the works have been greatly enlarged by the purchase of other premises, including a bleaching-green and a mill, and now all the operations necessary to convert

YORK STREET MILL.

the raw flax into the finished web are carried on. The visitor enters the main offices, and follows each stage of the manufacture as he makes the tour of the numerous buildings and rooms. A huge block is given over entirely to storing flax and stock linen, no less than six floors being required for the former. Technically, the raw flax becomes "line" after being hackled and dressed, the waste product being "tow." There is an unexpectedly great variety in the type

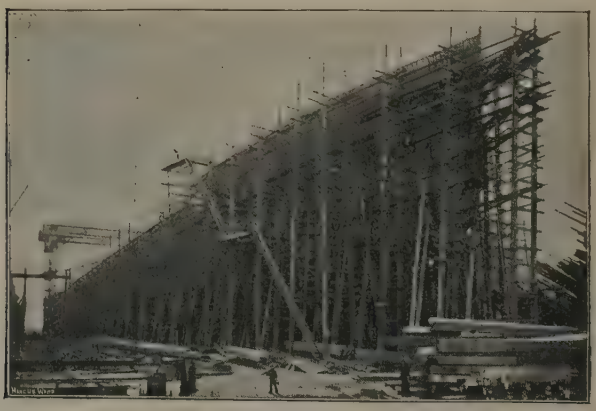
and quality of flax, that of Belgian growth from Courtrai being the finest. It is better scutched than our Irish product, and there is no doubt that local flax leaves room for improvement in this respect. Quality depends also of course upon the soil, humidity, and the season. The next block is the preparing mill, where the raw flax is first treated; it is dressed by hand, the rough flax being drawn through combs to remove the dirt and particles of bark. This is a very dusty process, and was very unhealthy; but now a cowl is fixed in front of the comb before each man, communicating with a ventilator shaft, in which suction is kept up by means of a rotary fan, so that all the dust is instantly carried away. On this floor are also the hackling machines, and machines for cutting the fibre into the middle and two ends, thus making three qualities, suitable for different purposes. These are now dealt with by hand, and sorted into a number of qualities, which sorting requires a good deal of judgment, and is of great importance.

The first floor of this building is used for tow carding and preparing, the second and third for flax or "line" preparing, which includes "spreading," done by women who feed the "line" on to leather bands, and the machine produces the "sliver," which then goes to the "drawing" and "roving" machines. The east end communicates with the spinning-mill by a six-storey building, on three floors of which "rove" is stored on its way to the mill, and on the ground floor of which is the mechanics' shop.

We next come to the great spinning-rooms, 221 feet by 42 feet; three of the floors are wet spinning-rooms. The spinning machines are tended by women and girls; and one may remark, *en passant*, that not the least of the causes of Belfast's success as a manufacturing centre is, that its staple industries employ all the available members of a working-man's family. Above the spinning-room is the reeling-room, from which a wire tramway runs to the drying-loft over the boiler-house. Here are the reeling machines which take off the yarn on to reels, some of the product being sold in the form of hanks and some on reels. These go to the hand-loom weavers, of whom there are still a considerable number. On the Henry Street side are

various blocks used as stores, offices, saleroom, etc., and containing lapping and measuring machines.

Leaving now the section known as the mill, we pass to the other half of the works, which is called the factory, consisting of preparing department and weaving sheds, containing about 1,000 damask and plain looms. Many other departments might be noted if space permitted; but the main driving-engines are of interest, as being among the few large beam-engines still in use. They have been, of course, modernized in various ways, and have proved themselves to be both reliable and economical. Next to the engine-house is the electrical plant, obtaining its power from the main shaft close by. The York Street Mill employs some 5,000 hands, of whom about half are women and girls, but not all of these are at headquarters, for there are several other establishments belonging to the firm, among them being the York Road Mill, the Muckamore Bleach-works, which last are most interesting, but too far from Belfast for the Association to inspect.



SHIPBUILDING.

The next great industry of Belfast is, of course, SHIPBUILDING, carried on by two firms, Harland & Wolff, Ltd., and Workman, Clark & Co., Ltd., who turn out vessels of

workmanship and design second to none, and whose rapid development is almost unprecedented.

It is now over 50 years since the foundation of HARLAND AND WOLFF'S WORKS was laid, the nucleus being the Belfast Ironworks, which intended to begin the manufacture of iron in Belfast. Their purpose was defeated by the expense of importing coal; but the second part of the enterprise—the ship-yard—prospered, in spite of the handicap of importing both iron and coal. Hickson & Co. were the proprietors till 1858, when the late Sir Edward Harland, Bart., M.P., took over their business and that of the Belfast Shipbuilding

THE LAUNCH.

Company. Since then the firm has been steadily progressing, and it now stands at the head of the shipbuilding trade of the world. From 1890 to 1894 it turned out the greatest tonnage of any concern in the Kingdom, and was only prevented from doing so in 1895 by the engineers' strike, which delayed the launching of several vessels. Last year the output exceeded their own previous world's record by about 10,000 tons, and created a new one.

Indeed, the growth of the "Queen's Island" during the last five years has been even more marked than its earlier achievements; and besides heading the tonnage list, they

have made great additions to the various departments; the works, a short time ago, covering 120 acres, with every appliance of the latest type, some of the new tools being of the finest description: for instance, the three huge "gantries" are each 100 feet wide and 90 feet high, and are arranged to travel the whole length of the "slips." The "Oceanic" and "Celtic," the White Star monsters, and the largest vessels afloat, were built under one of them; in fact, the first was arranged expressly for the construction of the "Oceanic," no less than £20,000 having been spent on the slip and the gantry before her keel was laid.

During the last five years many ships of the largest size have been constructed; including, besides the two named, the "Cymric" (the largest vessel employed in the transport service to South Africa), "Afric," "Medic," "Persic," "Runic," "Suevic," and "Athenic," for the White Star Line; the "Statendam," "Rotterdam," "Ryndam," and "Noordam," for the Holland-America Line; the mail-boats "Briton," "Saxon," and "Walmer Castle," for the Union-Castle Line; the "New England" and "Commonwealth," for the Dominion Line; the "Minneapolis," "Minnehaha," and "Minnetonka," for the Atlantic Transport Line; and other large vessels for the Leyland, Bibby, and Warren Lines. A notable feature in these ships has been their steady increase in size, the average for the last two years being nearly 13,000 tons.

The firm have also carried out some important repairs and alterations; among others, the "Scot" and the "Auguste Victoria" were cut in two and lengthened some 60 feet. The P. & O. liner "China" was also rebuilt after being on the rocks at Perim for many months; but perhaps the heaviest job of this kind was the work to the "Paris," after she had been on The Manacles. She was temporarily strengthened at Milford, and then re-docked in Belfast, where her bottom was cut out and renewed, as in the case of the "China," but, in addition, the vessel was completely altered, and new machinery supplied at a total cost of about £250,000.

Although the firm built vessels for the Admiralty some years ago, and have recently constructed the engines for

first-class battleships, Belfast has not built any of the latest warships; but it is hoped that, when the new graving-dock is ready, our premier shipbuilders will be entrusted with more work for the Government. Of course, however, the largest vessels they build are nearly twice the length and displacement of even the largest warships. They have now in hands the engines for H.M. SS. "Queen" and "King Edward VII." It is anticipated that the agreement which has recently been made with the Morgan Shipping Combine will give a still further impetus to the shipbuilding yards of Belfast.

The visitor to the works will begin with the main offices and the spacious drawing-office, where all plans and designs are prepared. These are naturally large, as ships of 600 feet to 700 feet are drawn to a scale of $\frac{1}{4}$ inch to a foot. Next will be seen the large building containing the joiners' shop, saw-mill, plumbers' shop, etc. A noticeable feature of this department is the arrangement for disposing of saw-dust and cuttings. Communicating with each machine is a large galvanized tube, in which rotary fans maintain a powerful suction, thus delivering the waste to the boilers, where it is used as fuel. Close to this is the mould-loft, in which the scale drawings sent out from the office are reproduced full size, and very carefully checked in the process, for upon the accuracy of this work depends the construction of the ship. The lines are first drawn in chalk, and when verified are cut into boards which go to the platers' and other shops.

On the way to the plating-sheds will be seen several vessels in course of construction, and also the huge gantries already referred to. Near the slips are the shops where the plates and frames are worked into shape. Here are punching, planing, shearing, bending, boring, and rolling machines, furnaces for heating bars and plates, and heavy hydraulic presses for various purposes.

The engine-works will also be visited, commencing with the erecting-shop, where engines of all sizes, from the propelling machinery of liners to the smallest pumps, will be seen in all stages. The pattern and other shops will be inspected, and in the foundry will be seen castings of all shapes and sizes. The last department is the boiler-shop,

a big shed fitted for building the heaviest marine boilers. The firm have not yet discovered a water-tube boiler suitable for merchant steamers, so most of the work on hands is of the well-tried Scotch type.

WORKMAN, CLARK & Co.'s yard has also had a notable history. Since their foundation, in 1879, it has grown from a small place of four acres, with a staff of 500 men, to its present position of fourth on the annual list of tonnage built in the United Kingdom, employing 5,000 hands and covering about 45 acres. They have built ships for the following among other companies: the Cunard, Allan, City, Harrison, Houlder, North-Deutscher Lloyd, Hamburg-American, and Lord lines, and the China Mutual, Ulster, West India and Pacific, and Ocean S.S. companies.

The following is the output of both firms since 1897:

	HARLAND & WOLFF.			WORKMAN, CLARK & Co.		
Year.	Ships.	Tons.	I.H.P.	Ships.	Tons.	I.H.P.
1897	10	84,240	45,850	11	24,743	16,100
1898	7	67,905	33,350	9	53,475	32,520
1899	7	83,634	66,150	10	45,018	29,950
1900	6	72,897	36,300	11	56,201	31,300
1901	7	92,316	76,000	9	58,459	33,000
Total ...	37	400,992	257,650	50	237,896	142,870

The value of the ships built by these two firms amounts to over £7,000,000 during the last five years, and their combined wages lists averages from £15,000 to £18,000 weekly.

DISTILLERIES.

Among the large distilleries of Belfast, Messrs. Dunville's holds a prominent place. The ROYAL IRISH DISTILLERIES were originally built in 1869-70, and rebuilt in 1876, after a fire which destroyed all the manufacturing part of the works. The buildings and plant are arranged for a weekly production of 40,000 gallons of whisky; and, in addition to the distilling part of the works, include extensive malt-houses, grain-stores, drying-kilns, and excise warehouses. The best spot for a general view of the premises is from the top of the malt-houses, where there is an enormous tank, up to which water is pumped so as to command all parts of the works.

Distilling is carried on night and day, as the process is practically a continuous one. The by-products—viz., grains, slumage, cake, etc.—have a large sale for feeding cattle, enormous quantities being sold in the neighbourhood of Belfast.

The grain is delivered from the granary (the capacity of which is about 250,000 bushels) to the top of the malt-houses by spiral conveyers and bands fitted with buckets; the wooden channels in which it travels are fitted with sliding doors, so that it can be delivered wherever required; it is then soaked in wooden vats until swollen, and the swollen grain passes on to the malting-floor, where it sprouts and becomes "malt." It is next dried, ground into "grist," and stored for use as required.

There are three immense "mash-tuns," in each of which about 2,000 bushels of malt are immersed at one time to undergo a churning process for some hours, until the whisky-producing qualities of the grain are exhausted. The fluid is stirred by fork-like arms, which revolve round the centre of the vat; it is then cooled and fermented in the tun-room, which contains 16 tuns of great size; the tuns are not filled more than two-thirds full, or they would overflow as soon as fermentation began. The liquor next passes to the three stills, through each of which it travels before the pure whisky is obtained; the spirit is discharged into vats, from which the casks are filled.

The water supply is drawn mainly from a boring of 400 feet, from which the water is pumped by forcing air to the bottom of the bore, after the manner of the American oil wells. Power is supplied by a modern compound high-speed engine, and there are four large Lancashire boilers, fitted with Green's economiser, everything being of the latest type.

In addition to the distillery proper, Messrs. Dunville have very large bonded stores, cooperages, etc., in Alfred, Adelaide, and Callendar Streets.

A staff of no less than 24 Excise officials are daily engaged.

Rope and Twine Manufacture.

Another great business which no visitor to Belfast should miss seeing is the Belfast Ropeworks, which has now held for years an honourable place as the largest rope, cord, and

twine manufactory in the world. Some idea of the importance of this trade to Belfast can be formed when it is stated that the output of cord and twine alone amounts to over 100 tons a week. Since its incorporation under the present management in 1876, the progress of the company has been most rapid. In 1879 there were under 100 employés; there are now 3,000, of whom a large proportion are women and girls. The consumption of twines and cords has greatly increased in recent years, and their titles are almost endless; but, as indicating merely the great variety of purposes for which they are used, the following may be named as a small

ROPEWORKS.

representation: fishing lines and twines of all classes, adapted for floats, cod and conger lines, Manilla lobster twines, Italian salmon twines, deep-sea lead lines, log lines, boat lacing, garden and hammock lines, tobacco lines, tethers, hemp sealing twines, sisal lines, etc., etc.; and an inexhaustible variety of twines for packing, sewing, heddle, and harness, away to the fine and fancy articles used in shops and warehouses, and also employed for household requirements.

The company manufactures every description of rope and twine, from the largest cable for an Atlantic steamer down to the finest fishing line, of which 60 fathoms weigh only an ounce A prominent place among the cords is assigned to those used for window-sashes. In consequence of the great friction on them, they require to be made in plaiting machines to resist the wear and tear. The visitor will find this one of the most fascinating departments, and it is wonderful to see the almost sentient way in which the bobbins of thread interlace with each other while revolving round the central tube, up which passes the plaited cord to the bobbin on which it is wound. Another important department is that devoted to binder twine for reaping machines, and some of the most recent machinery has been specially introduced with a view to meet the increasing demand for this twine.

One of the few processes in which machinery has not yet ousted manual labour is the manufacture of nets, and several hundred girls are employed by the company in this department. The energy and vigour of the girls at this work are wonderful, and would delight the heart of an artist in figure painting.

The section in which the balling machines are operated is also most interesting, and the apartments set apart for this work furnish, perhaps, a better idea of the magnitude of the general business of the company than any other, as here the twine is being dealt with to fit it for the various markets, and the enormous scale on which this is done shows how extensive are the operations carried on.

Finally, the packing-rooms will be seen, looking to the visitor more like a dock-shed than the forwarding department of a single company.

Tobacco Manufacture.

Amongst the numerous industries of Belfast, the manufacture of tobacco occupies a leading place, and the factory of Messrs. Gallaher, Limited, in York Street, is the largest in the United Kingdom. Messrs. Gallaher's old factory was in York Street, and this becoming too small for their increasing business, compelled them to

build a more extensive factory. The floor space of the new building is about eleven acres, and is fireproof throughout. The frontage in Earl Street is 900 feet, and the main factory occupies 300 feet of this. One end of the factory, the main entrance and offices, face York Street, along which an elevation extends some 200 feet. The main gateway enters off York Street, between the offices and inner side of the factory, and leads into a glass-roofed yard, which gradually widens as it penetrates towards the centre of the establishment, where it broadens out into a roomy square, from which access is obtained to every part of the works, including the factory, boiler and engine house, despatch department, press cellar, offices, etc. On the ground floor is a dining-room and a waiting-room for the workers. The entrance to all the floors of the factory is made by a staircase of solid oak, beside which is a hydraulic hoist. The floors consist of heavy iron beams resting on columns; brick arches spring from the beams, and are covered with patent wooden flooring, and the principal rooms are laid with marble tarazzo. At the upper end of the factory are situated the carpenters' shops, bonded store, laboratories, etc. The press-room contains hundreds of hydraulic presses, which are constantly full of Irish roll tobacco, valued at over £75,000. The offices are approached from York Street through a fine porch and vestibule, leading into a large hall, with mosaic tiles, and having on either side private offices, waiting-rooms, etc. Behind the main hall is the public office, which is lighted from the top by a large dome. The offices and factory are lighted by electricity, generated on the premises. Adjoining the factory is the private bonded store, a building six storeys high, having floor space of about 4½ acres. This building is fireproof, and is fitted up with hydraulic lifts, etc., giving every facility for working. Here are usually stored some 10,000 or 12,000 hogsheads of tobacco leaf. The firm turns out about 75 tons of manufactured tobacco weekly, millions of cigarettes, and a considerable quantity of snuff. It may be interesting to add that 25 years ago there were about twenty firms in Belfast engaged in the manufacture of tobacco. There are now only four, but Gallaher's alone

does about four times the business that the whole twenty were doing at that time.

Aerated Waters Manufacture.

Among the products for which Belfast is famous, not the least important is the aerated water manufactured by several firms. A short account of Messrs. W. A. Ross & Sons' works must stand for all. The first process is the manufacture of a syrup of sugar and water, made of the best cane sugar, mixed with certain flavouring essences, and filtered together into large crocks. The water is obtained from deep wells, tapping a bed of gravel remarkable for the purity of the water which it supplies; in fact, to this stratum is largely due the success of this industry.

The delivery-pipe of the well-pump is led into a large slate tank, glazed over, and fitted with glass stop-valves, etc., by which it communicates with a row of tanks containing the various flavouring liquids. On the floor below, the liquid is passed through the carbonating machines, in which carbonic acid gas, at 140 lbs. per square inch, is thoroughly mixed with and absorbed by the water. On the second floor are the bottling machines, which are most ingenious and interesting. With the majority of Messrs. Ross's machines the bottles are filled by a man on one side of the machine, and passed to another, who wires them; but there are also American "Crown" corking machines, which only require the services of one man, as they complete individually the whole process of filling, carbonating, and corking. Both corks and bottles are most carefully and thoroughly cleaned, the former by machinery, and the latter by hand, for no machine has yet been invented which can "see dirt" on a greasy bottle!

On the ground floor are the engine-room, the carbonic acid gas generator, the boiler-room, well-room, and the export packing-room. Leading out of the yard are cellars containing lime juice, cider, and hop bitters in bulk, and in another room lime juice, lemon syrup, and other cordials are made and bottled.

Ross's business was established in 1879, and, owing to the high standard of excellence, and the care taken to ensure

cleanliness, they do a large trade, and have their full share of the exports of aerated waters from Belfast, which the Harbour Commissioners' report shows to exceed 10,000 tons annually. In fact, mineral waters from Belfast have won a first-class reputation in every part of the world—a reputation shared alike by each of the six or eight leading firms in this business.

Printing.

In printing, Belfast has long held a high place, thanks to the standard set by the famous old firm of Marcus Ward & Company, of this city, which recently succumbed to the keen competition of younger establishments. One of these growing concerns was M'Caw, Stevenson & Orr's, who, in 1899, purchased the good-will and stock of the older and now extinct firm.

THE LINENHALL WORKS.

The business includes almost every branch of artistic and ordinary printing and lithographing, as well as several specialities, such as "Glacier" window decoration, "Seccotine," which "sticks everything," and other patent preparations. A large amount of work is done in books, pamphlets, etc. (of which this handbook is an excellent sample), and quantities of show-cards, labels, and other advertising devices are produced. Diaries, scrap-books, birthday books, albums, pocket-books, Christmas, menu, and other cards, and every variety of stationery are a most interesting and important

part of their work, in which they are carrying on the traditions of their predecessors. The visitor to the works will be struck, not only by the size of the establishment and the variety of its manufactures, but also by the excellence of its arrangements and the neatness and cleanliness of every part of the buildings, which cover some four of the seven acres in the firm's possession.

Five daily newspapers are printed in Belfast, the oldest of them being established for over 165 years. They have a large circulation in the Ulster district.

Biscuits.

The manufacture of biscuits was introduced into Belfast over fifty years ago, and from a small beginning it has developed into a considerable industry. The trade has been practically in the hands of Marsh & Company, and the fine pile of buildings in Donegall Street is a striking testimonial to the firm's success. The biscuit trade has provided a wide field of operations for the inventive engineer, and very frequently improved apparatus is introduced, until, at the present moment, the machinery in use by the leading manufacturers has reached a state of perfection almost human in its operations and results.

Marsh's factory is supplied with every modern contrivance for manufacturing biscuits and cakes, from the standard cutting machine to the intricate appliance for the production of "wafers." Over five hundred workers are employed. The trade is extensive, and the firm can compete successfully with English manufacturers for a share of their trade, while the Colonies account for a fair quantity. A reference to the Harbour Commissioners' reports for the last few years will show that the exports of biscuits from Belfast are usually equal to, and in many cases exceed, the imports: a remarkable fact, when it is remembered that our port is in daily contact with the "Land of Cakes"!

Aluminium.

The British Aluminium Co. carry on an important industry at Larne, where the "Bayer" process is at work, separating alumina from the various impurities contained in

a kind of clay known as bauxite, which is found abundantly in County Antrim. The bauxite is first ground to quarter-inch cubes, and is then calcined to destroy any organic matter contained in it. The calciner is an iron tube, revolving at a slight inclination, which delivers the roasted ore through a cooling tube to a second mill, where it is ground still finer. The ground bauxite is treated with a strong solution of caustic soda, under steam pressure of 100 lbs. per square inch, forming a soluble compound called aluminate of soda, the impurities remaining insoluble ; the mixture of aluminate and caustic soda having remained in the pressure chambers or "kiers" for about seven hours, a cock is opened, and the pressure in the "kiers" blows the mass up to the filter-presses at the top of the building. The aluminate is now carefully filtered twice, to ensure the alumina being free from iron, silica, etc., the residue from this process being waste product.

The separation of the hydrate of alumina from the soda is effected by the addition of excess of hydrate of alumina itself, and by constant stirring in large tanks provided with agitators. This process takes about thirty-six hours, when the agitators are stopped, and the hydrate settles to the bottom. The hydrate is next pumped through filter-presses, and thoroughly washed, to remove the last traces of soda, and dried by forcing compressed air through the cakes which it now forms. The dried hydrate is next calcined, to drive off the water, and is then in the form of anhydrous alumina. This product is very liable to take up water again, so it is heated to about 2,000 degrees Fahr., which causes it to crystallize, and leaves it ready for packing.

This process is only the first step in the manufacture of aluminium, the pure alumina being sent to the Company's factory at Foyers, near Inverness, where the electric reduction of metallic aluminium from this product is performed.

Thread Manufacture.

One of the most important enterprises in the neighbourhood of Belfast is the thread works owned by William Barbour & Sons, Ltd., at Hilden, near Lisburn. Founded on a very small scale about 115 years ago, they have gradually

grown in extent, until the firm now employ upwards of 5,000 hands, and control branch establishments of large size in America and Germany. The early history of the business is interesting as a type of other Ulster enterprises. Mr. Barbour (great-grandfather of the present representatives of the family) used to come over from Scotland to purchase the yarn then spun in the cottages in and near Lisburn; it occurred to him that it would be better to manufacture his thread, etc., on the spot, instead of bringing it first to Scotland. His son, the late William Barbour, carried on and enlarged the business; and as each new improvement was invented, he adopted it at Hilden, until he had a complete thread-making, spinning, dyeing, and bleaching works. The present output amounts to no less than 5,200 tons of single and twisted threads and yarns annually, and the wages paid total up to some £10,000 a month. The firm are now the largest manufacturers of linen thread in the world, and they produce an immense variety of work. The following are merely a few of the purposes to which their threads are applied: tailors' threads, boot and shoe threads, sole sewing and wax machine threads, carpet threads, bookbinders' threads, flourishing threads in all colours for embroidery, crewel-work, etc., netting twines and threads, gilling threads, upholsterers' and mattress twine, seaming and roping twines, Dutch twine, white twine, parcelling and packing twines, etc., etc.

The Barbours also make a great quantity of netting in all sizes, from sardine to sturgeon nets, and their machinery is of a new type, producing an excellent quality of net, which has taken honours at several fishery and other exhibitions. One of the pleasantest features of Hilden is the interest taken in the workers, many of whom live in the 350 houses surrounding the mill, and constituting quite a large village. There is a school attended by 800 children, a reading-room, and a dining-room, where hot meals are served at cost price.

Other Industries.

In bringing this short account to a close, it will, perhaps, be well to mention some of the other manufactures and

industries carried on in the Belfast district which have been omitted from lack of space. Engineering in various branches is carried on by several firms, of which the largest devote most of their attention to specialities, such as flax-spinning and weaving machinery, tobacco-making plant, mill engines, and machinery used in the manufacture of tea. Salt is mined on a considerable scale at Carrickfergus, where there are extensive deposits. The building trade is also of importance, with its allied businesses of brick-making and the importing and working of timber of all descriptions, both of which are the means of employing a great number of men. Curing provisions has long been a principal industry, and Belfast hams and sides of bacon are well known. Ice-curing and cold storage are engaged in by several firms during the summer. An extensive trade is done in grain, both home and foreign, in the milling of flour and barley, and in the manufacture of starch. Hats, boots and shoes, nails, matches, carriages, bottles, roofing and other felts, artificial manures, leather, beer, and furniture of all kinds, ornamental ironwork, stoves, stable fittings, and other specialities in iron, are among the minor manufactures, and the list is by no means exhausted. Enough, however, has been said to give a general idea of the extent and variety of the commerce of our northern capital.

PHYSICAL FEATURES OF THE BELFAST DISTRICT.

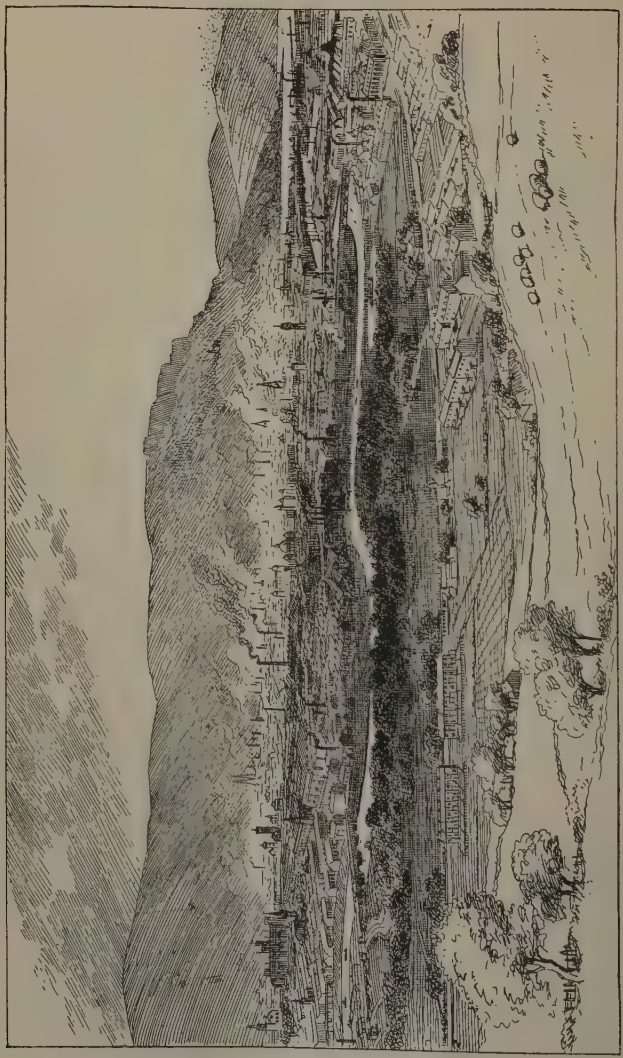
By J. St. J. Phillips.

The term Belfast District has been taken as embracing the counties of Antrim and Down. It is included between the parallels of 54° 5′ and 55° 15′ N., and the meridians of 5° 25′ and 6° 45′ W. The county of Antrim contains an area of 1, 190 square miles; the county of Down containing 956 square miles. Our district may also be referred to as the N.E. district of Ireland. It is bounded on the north by the Atlantic, and on the east by that portion of the Irish Sea known as the North Channel. Two watercourses also form the almost continuous boundaries on the west—the county of Antrim being separated from the county of Derry on the west by the Lower Bann river, from the counties of Tyrone and Armagh by Lough Neagh. The county of Down is separated from the counties of Armagh and Louth by the Newry canal and Carlingford Lough.

The counties of Antrim and Down are separated from each other by the Lagan river and Belfast Lough.

Configuration. — The surface features of the two counties present many contrasts; aud the student may find, in this small area, much that will repay his attention. By approaching the city of Belfast from the sea he will obtain a good preliminary survey of the contrasts in a comprehensive way. The county of Down presents a long coast line, backed at some distance by hills of little apparent elevation. Antrim, on the other hand, has generally the coast line dominated by steep escarpments, in places rising precipitously from the sea as bold promontories and headlands, or rising equally precipitously at no great distance from the present shore line. Inland is found a great plateau dipping gently to the west, covered with wide stretches of flat bog or deposits of glacial gravels and clays.

The streams flowing inland from the top of the Antrim plateau are sluggish and serpentine, but those flowing over



GENERAL VIEW OF BELFAST.

the edge of the escarpment to the sea are short and rapid in their courses, carving deep valleys or notches in the edge of the escarpment. County Down for the most part consists of undulating hills of no great elevation, except in the extreme south, where the Mourne mountains rise to a height of 2,796 feet above the sea. In Down, the slope of the river-courses is more even, and as they flow into the sea they produce flats and become sinuous. These contrasts between the two counties are due to the difference in the nature and statigraphical characters and arrangement of the rocks of the respective counties. Both counties have been subjected to the same sculpturing and denuding agencies in recent times, notably to glacial action, and subsequently to the usual modifying action of aerial and aqueous denudation.

County Antrim generally may be considered as a land owing its rocks to the Mesozoic and Cainozoic eras. No great series of earth foldings or mountain building strains have occurred in the county since the deposition of its rocks. Numerous faults occur which may be traced to the Eocene period, but the efforts towards rock crumplings or mountain building proved abortive; the rocks of our district could not resist the strain; and the crust of Mesozoic rocks, represented by the Chalk, broke into a number of "floes," the black lava finding its way to the surface through the wider fissures, converting them into dykes. So rapidly and evenly did the Chalk yield under this strain that the original horizontality of its beds of deposition has been but slightly affected. The general surface of the county may be described as "saucer-shaped"; that is, the central area consists of a plain somewhat depressed below the level of the edge or escarpment that overhangs the coast line. This "saucer-shaped" character is mainly due to the Pliocene or Post-Pliocene movements, which broke up the old Derry-Antrim plateau and dropped the basalt to the level of Lough Neagh. The edge of the saucer or the escarpment presents a fine and almost continuous geological section, basalt occupying the higher portions, under which occurs the Chalk—sometimes little more than a thin white line, but often of considerable depth,

as at Glenarm and the White Rocks, near Portrush. In places, Lias underlies the Chalk; and as the Lias is semi-plastic in certain localities, as at Carnlough and Garron, it produces its effects on the landscape by causing numerous landslips. It is only in such slipped masses that the dip of the strata deviates much from the horizontal.

To this general statement there are, of course, exceptions. Numerous natural causes have been at work since the deposition of the basalt of the Eocene times to modify and mask the "plateau" character of the inland districts of Antrim, or to modify the regularity of outline of the basalt escarpment. The course of river development may be studied in the romantic and picturesque Glens of Antrim to the greatest advantage: there we find many examples which might serve as text-book illustrations of the progress and "life history of rivers," from the steep and rapid torrents that pour as waterfalls over the edge of the basalt escarpment to the older types which have eaten back their courses far into the basalt plateau

Again, on the western side of the county are to be found slow and meandering rivers winding among the glacial sands and gravels that cover the basalt plateau, finding an outlet sometimes in Lough Neagh, like the river Main, the Six-mile Water, and the Glenavy river; or, like the Lower Bann, flowing into the open sea with a fall of 48 feet in a course of 35 miles.

County Down.—The county of Down consists, on the other hand, chiefly of rocks of the Ordovician era; the strata are much contorted by the great earth movements of post-Silurian times, so that it is difficult and often impossible to follow any given bed over any great area, or to draw a sharp dividing line between two beds of different ages. In a few places rocks of a later age occur, as in the Comber river valley, where Triassic rocks are to be found capped by a sheet of basalt, an outlier of the Antrim plateau; but these rocks still retain their original horizontality, and occupy a small area.

In the centre and in the south of the county are to be found two districts of mountainous character. Between Dromara and Castlewellan is found an outcrop of granite

attaining an elevation of 1,755 feet in Slieve Croob, with other dominant elevations adjacent, notably Cratlieve, Slievenisky, and Slievegarran. These granite hills probably originated in latest Silurian times. Granite of the same age is also to be found at Goraghwood, near Newry, and at Castlewellan, to the west of Newcastle. It should be noted that the granite of Slieve Donard is of a much later age, probably owing its existence to the same plutonic disturbances that gave rise to the basalt of Antrim. The district of the Mournes attains considerable elevation, the dominant peaks being Slieve Donard (2,796 feet), Slieve Commedagh (2,512 feet), Slieve Bingian (2,449 feet), Slieve Bernagh (2,394 feet), and the two Slieve Meels. Most of the summits are dome-shaped, as is common with granite mountains, but some are crowned with crags and sharp peaks (hence the name, Slieve Bingian—the mountain of the sharp peak).

Coast Indentations and Lakes.

County Antrim.—The coast of Antrim, while possessing no great bays (except the land-locked Larne Lough), is characterised by numerous sinuosities with intervening headlands. The bays on the east coast are the continuations of the valleys with their river courses which form the Glens of Antrim. The most notable are Cushendun Bay, at the foot of the Glendun Valley; Red Bay, at the foot of the Glenariff Valley; Carnlough Bay, and Glenarm Bay, at the foot of the Glenarm Valley. Larne Lough is enclosed from the sea by the peninsula known as Island Magee; the lough is about 6 miles long, and at its entrance to the sea is less than a quarter of a mile wide. Belfast Lough, the extension of the Lagan Valley, is 14 miles long and 7 miles wide at its mouth.

County Down.—The chief indentations of the County Down coast are Strangford Lough, Dundrum Bay, and Carlingford Lough. Strangford Lough covers at high-water an area of 57 square miles. Much of it is too shallow for navigation purposes, consisting of shallows and sloblands. A considerable area of this lough could be easily reclaimed, and already parts of it near Newtownards have been so

treated. The entrance to the lough is about one-third of a mile wide and about five miles long. Here, at certain states of the tide, the current runs at from 5½ to 7 knots for ordinary tides to 9 knots an hour for some spring tides, generating whirlpools that are dangerous to boats attempting to enter the lough. We are led to suppose that its present outlet dates from the end of the Glacial period. Before this, its basin, from evidence found in the glacial deposits to the south of the district, seems to have been shallower than at present, containing a large deposit of Carboniferous limestone. The pre-glacial entrance was probably situated between Ardglass and Dundrum. Between these points we find extensive deposits of glacial sands and gravels, with a large percentage of Carboniferous limestone erratics; and the district known as Lower Lecale, from Downpatrick to the east, bears evidence of extensive glaciation, the striæ running N.N.W. and S.S.E.

The next coast indentation is Dundrum Bay, bounded on the north-west by extensive sand dunes. Carlingford Lough, nine miles long and about two miles wide, separates County Down from County Louth, and is bounded on either side by the steep slopes of the Mourne mountains and Carlingford mountains.

Drainage and Rivers.

The county of Antrim possesses one main watershed, embracing the summits of the hills that occur parallel to the east coast. It follows the line of hills parallel to Belfast Lough in a N.E. and S.W. direction. The following are the chief peaks or eminences in the crest beginning from the north: Carnanmore (1,254 feet), overlooking Torr Head; Slieveanorra (1,676 feet), at the head of the Glendun river; Trostan (1,817 feet), Collin Top, Slemish (Slieve Mis, 1,437 feet), Agnew's Hill, Cave Hill (Ben Madighan, 1,188 feet), overlooking Belfast; Black Mountain and White Mountain, a few miles north of Lisburn. This line of summits deviates from the straight line, where the watershed has been eaten back by the rivers that have excavated the valleys forming the Glens of Antrim. To the east of it the rivers flow into the North Channel with steep and

sometimes precipitous courses over the edge of the escarpment; to the west of this line the rivers find their way over the plateau that forms the greater part of inland Antrim towards the west. The westerly trend of these rivers, however, is modified by the presence of a ridge stretching from Dunloy to near Ahoghill in a north and south direction. The presence of this ridge parallel to the main watershed, running north and south, deflects the rivers from their westerly course, giving them a southerly trend till the valley reaches Lough Neagh. The river of the Lower Bann is the main artery from Lough Neagh to the sea. The Lower Bann has a wide drainage area: from the east it receives the drainage of the greater part of Antrim; on the west the watershed of its drainage area extends to the Sperrin mountains and the range of hills that form the western limit of the basalt plateau which we have already met with in Antrim.

In the County of Down the watersheds are harder to determine. One such is well defined; namely, that running from the Eagle Mountain (2,084 feet), in the Mourne range, to Slieve Croob, about six miles south of Ballynahinch. On the slopes of Slieve Muck in the Mournes, the river Bann begins its course, and flowing north enters Lough Neagh; the river Lagan has its source on the slopes of Slieve Croob, and after a winding course enters Belfast Lough.

Antrim Rivers.

Having briefly pointed out the watersheds, we may now consider the rivers in detail. Beginning with those on the east slope of the watershed, we have the Glendun river, entering the sea at Cushendun; the Glenariff river, entering the sea at Red Bay; the Glenarm river. These rivers, though of little importance on account of the shortness of their courses, embosom in their valleys some of the most charming scenery in the county. The chief river on the western slopes of the main watershed is the Main. This river pursues a southerly course, intercepting on its way numerous tributary streams pursuing a westerly course from the main

---

See Map of Belfast and the N.E. Counties; scale, 4 miles to an inch (published by Bartholomew).

watershed; ultimately it enters Lough Neagh below Randalstown. The extreme north of Antrim (with the exception of a small area near Ballycastle) is drained by the Bush river. This river enters the sea below the town of Bushmills. The Lower Bann has been noted as forming the western boundary of the county.

Rivers of Down.

A number of rivers originate on the slopes on either side of the watershed found in the southern half of the county. To the east of the Mourne mountains are a number of small streams, such as the Kilkeel and Annalong rivers, with short and steep courses; while to the west the gradients are easier, the courses much longer, and the rivers attain to much more importance, the Upper Bann having a course 40 miles long, and the river Lagan a course of 38 miles.

In the "lowland" district north of the line between Hillsborough and Downpatrick, the following rivers are found flowing into Strangford Lough: the Quoile, Blackwater, and the Comber river; draining into the Lagan, the Ravernel and other small streams.

Lakes.

The most important of these is Lough Neagh; and being the largest expanse of fresh water in the United Kingdom, it is worthy of some consideration. It is about 14 miles long and $8\frac{1}{2}$ miles broad, occupying an area of about 98,224 acres. It is bounded by five counties—Antrim, Derry, Tyrone, Armagh, and Down—each of which includes a portion of the lake. Though of such size, it is one of the shallowest of our British lakes, its average depth being less than forty feet. Soundings made in Lough Neagh reveal some interesting facts. A shallow margin extends around the shores. This margin is of considerable extent, and varies in depth from two to three feet; at the edge of this margin there is a sudden and steep depression, when the lake deepens gradually to a depth of fifty feet in the centre. Between Langford Lodge and Kiltagh Point, near the centre of the lake, occurs a well defined channel. This channel may be traced in a northerly direction for about twelve miles, attaining

a maximum depth of 102 feet off Skady Island. Much has been written, much has been handed down by tradition, as to the origin of this lake. Some of the tradition has formed the subject of one of Moore's melodies. Many popular beliefs are still extant as to the wonderful "petrifying" and the medicinal powers of the waters of the lake. They are suggestive if not satisfying. According to the annalists in the first century of the Christian era, when Lughaidh was King of Ireland—i.e., from A.D. 65 to A.D. 73—a fountain burst forth and continued to flow until it filled the valley now occupied by the lake. But if this valley existed with a bar at its lower end, as is at present at Toome, the question may be asked how it was that the depression was not filled with the waters that would flow into the basin from the rivers; that is, if these present rivers still flow in their ancient beds, and that the rainfall at that period was not less than at present. The alternative is that the depression did not exist before the reputed outflow, and that the formation of the lake was caused by the sinking in of the area now covered by the waters of the lake. The legend is just possible so far as it deals with the statement that the lake originated at this period in the history of Ireland, but further than this we need not place much reliance as to the cause ascribed by the tradition. It was much easier for the people of that time to observe the fact of the lake being formed, than for them to arrive at the correct cause of its origin; they would more readily notice that the waters were covering and encroaching on their valley, than that their valley was actually sinking below the bar level at the north end of the lake. We may sum up briefly some of the observations that have a bearing on the subject. A series of large faults occur in the rocks around this district, resulting in serious displacement of the strata: these, however, are common all over the plateau of Antrim, but need not necessarily have caused the depression in which the lake occurs, though the subsidence of the land may have occurred along these lines at a much later date.

The researches of William Swanston and Clement Reid are of considerable importance. These observers followed up the investigations of others who had found shells

which they referred to the fluviatile genus *Unio.* These shells have been more recently dug out by Mr. Swanston in 1878 from Crumlin river beds, and found to be the common *Mytilus edulis.*[1] These occur in a dark blue mass of clay, which rests on true boulder clay, with numerous erratics derived from the boulder clay; hence the clays cannot be earlier than the Glacial period. The *Mytilus* beds point to the fact that the whole of the area was connected with the sea at some period subsequent to the Glacial period. A further point of interest is that, recently, the shrimp *Mysis relicta* has been taken living in the depths of the present lough. That the river systems of the country had been established before the subsidence which is now occupied by the lake, is suggested by the fact that a well-defined channel can be traced on the bed of the lake following the course that would have been taken by the Bann river before the subsidence of the ground at this portion of its course. From these evidences we are therefore led to conclude that the lake had its origin subsequent to the Glacial period. Popular tradition places it in the Human period, and it may not be improbable that the tradition is altogether without foundation. (See Sir Archibald Geikie's *Ancient Volcanoes of Great Britain*, vol. ii, page 448, *et seq.*) Silicified wood is found along the shores of Lough Neagh. Local peasantry attribute petrifying qualities to the waters of the lough; but as the silicified wood in question is found also in the boulder clays to the south and east of Lough Neagh, it would appear that specimens found on the shore have been derived from these beds, which, in turn, had found their supplies from deposits of the same age as the lignites of Ballintoy. Silicified wood has also been found in boulder clays at Armagh, indicating an abundant forest from which such widespread erratics have been derived.

The only other lakes calling for mention in the county of Antrim are Lough Mourne, four miles north of Carrickfergus, and Lough-a-veema, six miles by road, north-west of Cushendun. This latter lake is of interest from the

[1] *Geological Magazine*, February, 1879.

existence of a subterranean channel which drains the lake into the Carey river.

In County Down a few lakes are to be found among the Mourne mountains. These lakes are dammed by moraine material, and evidently originated in the Glacial period. Numerous small lakes occur on the low grounds.

Islands.

The most important island off the Antrim coast is Rathlin—called by the natives Raghery ; it figures on Ptolemy's map as Rechra. It is about six miles north of Ballycastle, and, geologically, is similar to the mainland of Antrim, which it also resembles in scenery: it contains about 3,400 acres. Between this island and the mainland a strong tide runs. This stretch of water was known as the "Moyle," and is referred to in an old Irish legend, and in Moore's well-known lines :

"Silent, O Moyle, be the roar of thy waters."

Off the coast of Down and in Strangford Lough are a number of islands of small size. The most noted are the Copeland Islands, off the north-east of Down.

STRATIGRAPHICAL GEOLOGY.

We may claim for our district, with a considerable amount of justice, that it presents to the geologist, within its small area, a great variety of remarkable features and rock exposures which will prove well worthy of detailed study.

We find in our counties representatives of the four great eras. The Archæan period is possibly represented by the schists and gneisses of north east Antrim ; the Palæozoic era is represented by the Ordovician and Silurian rocks of County Down, by the Old Red Sandstone near Cushendall, by an interesting patch of Carboniferous sandstone near Ballycastle, County Antrim, and by Carboniferous shales near Belfast. Just beyond the boundaries of our district Carboniferous limestones are found at Carlingford and in County Tyrone.

The Mesozoic era is represented by Triassic sandstones and marls at various localities from Newtownards to Murlough Bay, by the Jurassic rocks at the foot of the escarpment, from Colin Glen, near Belfast, to the celebrated Lias sections at Portrush, and by the Cretaceous rocks of Antrim.

The Cainozoic era is represented in Antrim by a remarkable series of basaltic and other igneous rocks, ranging from acidic series, as in the Mourne mountains granite, to basic series, as in the basalts of Antrim—varying from the holocrystalline to glassy type in their respective series.

Of the Post-Pliocene times, our district presents many problems worthy of investigation in the varied phenomena of glacial geology. The estuarine clays and raised beaches bring us to a more recent period, and are rich in records which will assist us in our retrospective efforts to restore the geography of the land when first peopled by man.

The local representatives of the above-mentioned rocks present features somewhat interesting, as in many cases they are the remains of shore deposits, and the strata often are found thinning out as if they represented the deposits of ancient sea-margins rather than of deep depressions.

Archæan (?) Rocks.

In the north-east of Antrim, from Cushendun to Murlough Bay, the coast scenery differs from that we have first seen in our entry into the county from Belfast Lough. The basalt escarpment is no longer the characteristic feature of the landscape ; instead, we find rounded outlines and rugged and uneven surfaces.

The rocks are schists and gneisses, much folded and crumpled, and so metamorphosed that it is now impossible to determine the origin of the series. To understand them, reference should be made to a good geological map of the British Isles, when it will be noticed that these rocks in our locality are but an exposure of an ancient ridge which appears in Ireland near Cookstown, in County Tyrone; the same ridge may be traced to the Mull of Cantyre opposite. In our district this ridge represents a watershed traversing in a north-easterly direction the peaks of Slieveanorra, Agangarrive, Crockaneel, and Carnanmore hills. To the

north of this ridge the rocks dip towards the north-west at about thirty degrees, but this dip is subject to many local variations; to the south-east of the ridge the dip is towards the south-east. Similar rocks (lithologically) form another ridge in the highlands of Donegal. These two ridges are probably the results of great earth movements that took place at the end of the pre-Cambrian times: since then the rocks have undergone many further vicissitudes of elevation and depression, as well as surface weathering. The rocks, as we now find them, are mica schists and gneisses, with many local variations of character; in places, as at Torr Head, bands of black calcite occur four inches thick; here also the gneiss is altered into "augen gneiss," with rounded grains of quartz, the other materials seemingly flowing round and enclosing the quartz grains. In other places the schists are highly foliated, with an easy cleavage along the flattened micaceous planes, which glisten brightly on exposed surfaces.

In the neighbourhood of Torr the rocks are much faulted. In many places the beds are highly foliated and contorted; numerous veins of quartz occur traversing irregularly the planes of foliation. Reference to the Geological Survey sheets, Nos. 8 and 14, may be made. These two sheets include all the Archæan rocks exposed at the surface in this district. On the west the outcrop is bounded by a long fault, the position of which is closely followed for a considerable distance by the line of the Ballycastle railway. The mountain of Knocklayd, adjacent to this line on the east, is crowned with a capping of basalt, which allows us to arrive at a conclusion as to the downfall throw of the fault, by comparing its altitude with the level of the corresponding exposures on the west side of the fault.

Near Cushendall is found another boundary of the schist series. The line runs from Retreat station in Ballyemon Glen to Cushendun. To the south-east of this line are found the conglomerates of the Old Red Sandstone.

The southern boundary of the outcrop pursues an irregular line, along which occur Cretaceous beds capped with basalt. As to the age of the series, the only conclusion that can be arrived at, from local evidence alone, is, that the

schists are pre-Devonian, as pebbles of the schist and numerous pebbles of quartz, apparently derived from the veins that traverse the schists, are to be found in the conglomerates of Old Red Sandstone age. That these pebbles are much rounded, and that so large a percentage of them are composed of hard quartz, would lead us to infer that a very considerable time elapsed from the formation of the schist series to the deposition of the rocks of the Old Red Sandstone period.

It is only by correlating the schists with the exposures of lithologically similar rocks occurring in the Mull of Cantyre, that we can gain any light as to their age; and in doing so, we are led to place our series among the "Archæan," between which and the overlying Devonian conglomerates we find in the north-east of Antrim no representatives of the Cambrian, Ordovician, or Silurian strata.

The Silurian Rocks of the District.

Passing from the early rocks of the north-east of Antrim, the next representatives of the geological series found in our district are the Ordovician rocks of the County Down. Mr. Swanston, F.G.S., and Professor Lapworth have published the results of their investigations in the appendix to *Proceedings* of the B.N.F.C. for the year 1887; more recently, officers of the Geological Survey have gone over the ground, and the results arrived at are summarized in a *Guide to the Collection of Rocks and Fossils belonging to the Geological Survey of Ireland*, 1895.

These rocks are found widely distributed throughout the whole of County Down, and occupy the entire of the lowlands. Only on the slopes of the Mourne mountains are they to be found at any elevation, and their elevation there is due to the intrusion of a large laccolite of granite of much later age.

They extend beyond the limits of the county into Armagh, Monaghan, Longford, and Cavan, also into Louth and Meath on the south. Tracing the line of strike to the east, we find the same rocks occurring in the lowlands of Scotland; and in Mr. Swanston's paper above referred to the beds or zones in these two districts have been closely correlated.

Along the southern shores of Belfast Lough occur representatives of the Llandeilo and Lower Bala series; that is, the representatives of the Lower Silurian or Ordovician. Between Orlock Point and Donaghadee the rocks pass into the Llandovery series of the Silurian system; while still further south, near the extremity of the Ards peninsula, occur representatives of the Tarannon shales.

The Ordovician rocks of County Down and County Cavan are of the Moffat type, while to the north-west, in County Tyrone, they are of the Girvan type. In County Dublin and further south they are of the Lake District type.

As in the earlier rocks we trace a general line of strike for similar beds, so in the Ordovicians we may correlate the various rocks occurring in Ireland by tracing a similar north-east and south-west series of strikes, and comparing the Irish rocks with those of the neighbouring land of Great Britain. The Silurian rocks of County Down, as found at Coalpit Bay and at Tieveshilly, near Portaferry, correspond with the Birkhill and Gala beds of the south of Scotland in the graptolites which they yield.

In Swanston and Lapworth's paper above referred to, the conclusions there arrived at are summarized as follows:

"The Silurian rocks of County Down are, from the foregoing, proved to belong to several distinct divisions of the system.

"1st. The lowest, exposed at Coalpit Bay, the shales of Ballygrot, Craigavad, etc., are the representatives of the Glenkiln shales, the equivalents of the Upper Llandeilo of Wales.

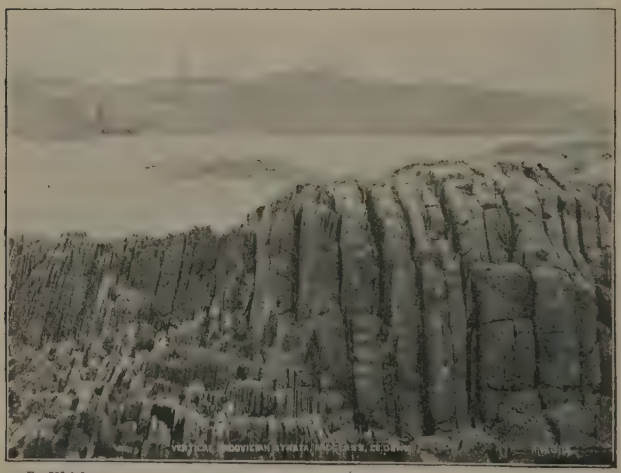
"2nd. The black shales of Carnalea and the barren mudstones at Coalpit Bay represent respectively the Lower and Upper Hartfell series, the equivalents of the Bala or Caradoc.

"3rd. The black shales at Coalpit Bay, characterized by the zones of *D. acuminatus*, *D. vesiculosus*, *M. gregarius*, and *D. cometa*, represent in part both the Lower and Upper Birkhill shales, which are paralleled with the Lower Llandoveries.

"4th. The grits and conglomerates which immediately succeed the latter are of the same age as the Bala series, and occupy a high place in the Middle Silurians.

"5th. The black shales and associated flags at Tieveshilly, near Portaferry, occupy either the extreme top of the Middle, or the base of the Upper Silurians, and are the highest Silurians yet recognised in the north-east of Ireland.

"The geographical relation of the area under consideration to that of South Scotland, and the general direction of the strike of the rocks in both districts, would naturally lead to the expectation of a certain degree of similarity between their geological characters. From the foregoing, however,



F. Welch. *Photo.*

VERTICAL STRATA, ARDGLASS.

it is clear that not only generally, but in detail, do they correspond in a remarkable degree. While it would, perhaps, be impossible, owing to the imperfect manner in which the fossil bands are exposed, to unravel the sequence of the various bed in County Down from an examination of them alone, the key afforded by the recent researches in the Scottish beds has made the subject a matter of ease. We are thus enabled for the first time, with some amount of certainty, to arrive at conclusions regarding

the physical geology of the district. The three graptolitic shale bands and their associated mudstones have been overlaid by the grits and conglomerates so conspicuous in the county; all were folded into vast waves, the crests of which ran in the direction from about north-east to south-west.

"Subsequent denudation completely altered the contour of the district; and, judging from the remnants of Carboniferous strata at Castle Espie and Cultra, it seems to have been covered by rocks of that age, and to have been again upheaved and subjected to denuding agencies, which probably left it in almost its present state."

"The north-western boundary of the Silurian area has been subjected to the greatest amount of upheaval, and, as denudation has reduced all to a somewhat uniform elevation, the lowest beds are here consequently most exposed. The Ballygrot beds form the axis of what was the most north-westerly anticlinal; the black shales of Crawfordsburn, Carnalea, and Orlock Point possibly represent waves of minor importance; while that at Coalpit Bay seems to have been one of considerable elevation."

Old Red Sandstone.

The only representative of the Devonian system in our district is found in a small area round Cushendall. The exposure extends from the caves at Cushendun to Ballyemon Glen, a distance of six miles—the greatest width being three miles. No fossils have been found in the rocks in this district, but on general lithological grounds they have been referred to the Old Red Sandstone, being considered as remnants of the Lake Caledonia basin. On the north-east boundary of the exposure the rocks are found resting on the Archæan schists, and on the south-west they are covered by beds of Triassic age. Finely exposed sections occur along the shore from Cushendall to Cushendun. At the north-end of the exposure at the caves at Cushendun, the rocks consist of a coarse conglomerate with intermediate sandy strata; the pebbles are composed chiefly of large and rounded blocks of quartz and schist that have been derived from the ancient Archæan ridge to the north-east; the matrix

in which these pebbles occur is highly silicious; the whole mass, after consolidation, has been subject to considerable crushing and shearing; the hard quartz blocks often are found split into several slices. So thoroughly does the matrix cement the various materials, that, in the face of the shear plane, the fracture passes through the quartz block rather than dislodges it out of the matrix. The strata are much broken and displaced by small faults and dislocations, on the face of which these features can be clearly seen. In the exposures of this rock near Cushendall, the rock is less coarse in the character of its contained blocks, and a greater percentage of pebbles of quartz porphyry occurs. Still further to the south, in Ballyemon Glen, the rocks become more sandy; good sections of the beds can be seen in the stream to the north of Retreat station, and at this point their relations to the underlying and overlying beds can be well observed. The general strike of the beds is N.E. and S.W., and the dip varies from 30 to 60 degrees south-east, according as the dip has been modified by local dislocations.

Carboniferous System.

Lower Carboniferous Sandstone.—Rocks of this age are found exposed in the neighbourhood of Ballycastle, in the north of Antrim, where the series is represented by thick sandstones, shales, coal seams, thin limestones, and ironstones. In character, the rocks of this district differ from the Lower Carboniferous series in the central plain of Ireland, and have been correlated with those of the west of Scotland; their appearance has also been likened to the colliery of Burdie House, near Edinburgh. On this account they have been referred to as *Calciferous Sandstone*. Professor Hull states: "The series in County Antrim belongs, in all probability, in part to those of the 'Upper Calciferous,' the 'Carboniferous Limestone,' and the 'Yoredale' stages of Scotland and the North of England; and amongst the points of analogy are the occurrence of thick beds of red and yellow sandstones, of black band ironstone, and of earthy limestone in thin beds, containing marine fossils. These beds, only a few feet in thickness, are the

meagre calcareous representatives of the great limestone formation of the central plain of Ireland, which has undergone a remarkable change in mineral characters and thickness in this direction, in keeping with the general change which the formation undergoes throughout the British Isles."

The Ballycastle coalfield was considered by Sir Richard Griffith as one of the oldest in the British Islands. In 1770, in pushing forward an adit towards a bed of coal, the miners struck an old working of considerable extent, which branched out into thirty-six chambers. The antiquity of this early working was such that even tradition had nothing to say of it, though the passages indicated very extensive workings in early times. The sides and roofs of the passages were covered with sparry incrustations, and in places the remains of old implements and decayed baskets were found.

Many attempts have been made to develop a trade in connection with the Ballycastle coalfield, but no effort has yet seemed to have succeeded in establishing itself on a successful and permanent footing.

The coal-bearing strata may be divided into three districts: (1) Colliery Bay, extending from Ballycastle to Carrickmore dyke; (2) Fair Head and Murlough Bay district; (3) the Glenshesk and Carey river district. Each district is divided from the others by dykes, while a number of faults traverse each coalfield. The Great Gaw dyke, stretching from Ballycastle to Murlough Bay, separates the first and third districts. The Carrickmore dyke separates the first and second districts. In the first district the sandstones are generally yellowish; in the second district the sandstones are thicker bedded and reddish, with a bed of purple limestone, and are capped by the dolerite of Fair Head, which has also intruded as sills into the sandstones; in the third district the prevailing beds are shales, with thin seams of coal and limestone; but in this district the rocks are generally covered by glacial drifts and gravels.

Owing to the number of faults and dykes, the dips of the beds vary in the different sections, and the numerous displacements have interfered with any extended efforts being made to develop the natural resources of the district. The

thicknesses of the coal vary in the various districts from a few inches up to six feet. In the Salt Pans colliery, coal varying from six to nine feet was found about forty yards below sea-level.

The Murlough Bay colliery contains six coal seams, four of which are bituminous: two of these, known as the White Mine and Good Man's Vein, are two feet six inches thick.

The sandstone of the Ballycastle district has been used locally as a building stone with success; and if the beds are carefully selected, a durable building stone may be obtained. The weathering properties of the stone may be seen in the Boyd Church, Ballycastle, built in 1756; in some of the old tombstones at Bonamargy Abbey; and in many of the local fence walls.

Many fossils are recorded from the Lower Carboniferous rocks of Ballycastle. Plant remains are particularly numerous—*Sigillaria* and *Stigmaria*. *Sphenopteris flabellata* is recorded from yellow ochreous shales at Fair Head. *Lingula squamiformis* is abundant in the shales, while the limestones yield fish remains referred to *Ctenacanthus* and truly marine types of shells.

At CULTRA, on the southern shores of Belfast Lough, there is a small outcrop of Lower Carboniferous shale, dipping north about 20°. These rocks have yielded numerous specimens of *Modiola MacAdami* in the darker shales, while numerous fish remains, chiefly scales of *Holoptychius Portlocki*, have been obtained from the more massive beds of lighter-coloured limestone near the battery wall. A line of fault, running north and south, bounds the rocks on the west, separating them from Triassic sandstones; while to the east the rocks are, or were, covered by Permian. These Permian beds are, however, only to be observed at low ebb tide.

CASTLE ESPIE.—Further south, at Castle Espie, near Comber, is found an exposure of Carboniferous limestone, resembling closely the Carboniferous of the central plain of Ireland. The rock rests unconformably on the Silurian, and has a considerable dip. Extensive lime-works were started here about thirty years ago, but at present operations are not

being carried on, and the fine sections at one time exposed in the quarries are now covered with water, and much of the rock in the district is covered with boulder clay. That the Carboniferous limestone covered a considerable area of the adjoining Strangford Lough seems to be indicated by the numerous erratics of Carboniferous limestone found in the boulder clay to the south of this locality. The rock surfaces also, when cleared of their covering of boulder clay, exhibit well-marked glacial striæ.

The fossils obtained, when good sections were exposed, were of remarkably large size. *Productus giganteus*, *Actinoceras giganteum*, *Athyris ambigua* have been recorded.

Another small patch of Carboniferous limestone occurs at Cranfield Point, the most southerly point of County Down. It is evidently a continuation of the fine development of marine Carboniferous limestone found on the opposite shores of Carlingford Lough.

Triassic System.

Rocks of this age occur in both Antrim and Down. They form the basement rock of the Lagan valley from Belfast to Waringstown. They are widely exposed along the north shores of Belfast Lough, where they are lost under the sea on one hand, but extend right up to the foot of the basalt escarpment, giving rise to gently undulating uplands. On the south shores of Belfast Lough they extend as far as Cultra, and are there found resting unconformably on the edges of uptilted Lower Silurians. A wide belt of Trias extends from Belfast down the Dundonald valley to Newtownards and along the shores of Strangford Lough to Greyabbey.

The Trias in this district has representatives of the Lower Trias or Bunter, and the Upper Trias or Keuper.

Bunter.—The English Bunter has been subdivided into upper variegated sandstones, pebble beds or conglomerates, and lower variegated sandstones.

From lithological similarity, the sandstones of the Lagan valley have been referred to the upper variegated sandstones of Bunter age; the pebble beds of the English series as found in Cheshire not being found in our district, unless

we may refer certain beds mentioned by the officers of the Geological Survey occurring near Beechmount as belonging to this subdivision.

Sections in the Bunter sandstone are to be seen in many localities near Belfast; notably, along the Shore Road, ripple-marked sandstones occur at the brickworks (Skegoniel Avenue) and at Fortwilliam Park; on the shore at Whitehouse and Macedon, in the County Antrim; while in the County Down a fine section may be seen at the now disused quarry near Dundonald.

F. St. J. Phillips. *Photo.*

SCRABO HILL NORTH QUARRY.

The beds consist of soft bright red and yellow variegated sandstones, sometimes false bedded. These beds merge insensibly into beds of very similar character that have been referred to as belonging to the Keuper series of sandstones, red, white, and purplish, without any intermediate basement conglomerate.

KEUPER.— The Keuper Sandstone is admirably exposed in the quarries on the sides of Scrabo Hill, near

Newtownards. Here the beds are frequently ripple-marked, or show suncracks, and occasionally rain pitting, with the lucidity of a text-book diagram. Frequent layers of clay separate the massive beds of sandstone. False bedding is to be frequently observed, particularly in the sides of the rock faces of the passage leading into the main quarry to the south of the hill. The rock is extensively quarried for building stone, and, if carefully selected, yields an excellent building material for local use, for which there has always been a large demand.

The preservation of the Triassic strata at Scrabo is due to the protection afforded by the capping of Tertiary basalt. The various sections show, in a remarkably distinct manner, dykes and sills of the intrusive basalt. In the north quarry the sills can be seen branching from the vertical dyke; they can be traced and followed for considerable distances, sometimes following the bedding planes of the sandstone, and at times breaking through them for short distances to renew their horizontal course again for a time. In the south quarry a dyke about seven feet wide can be seen breaking through two such sills, and ultimately through the basalt capping overlying the sandstone. For the student of physical geology there are few places that can excel Scrabo Hill in furnishing, in a limited space, so many illustrations *in situ* of the principles of his science.

Keuper Clays occur at various localities near the flank of the escarpment along the shores of Belfast Lough, and at an elevation of 150 feet near Woodvale Park, on the western side of the city of Belfast. The beds consist of thick red marls with bands of grey marls and thin sandstones. In places the marls attain a thickness of 800 feet. Numerous bands of gypsum occur irregularly through the mass; some of these bands, as found on the Forth river, being six inches in depth. These bands are well exposed on the railway cuttings beyond Kilroot and Cloghan Point, and also occur on the shore at Waterloo, north of Larne Harbour, where the marls and sandstones merge into the Rhætic series.

Rock Salt occurs in considerable abundance in the Keuper marls at Carrickfergus and Magheramorne, and

several mines have been opened at Duncrue, Eden, and Ballycarry, from which large quantities of rock salt have been exported. The section of the Duncrue mine is as follows:

	Feet	Ins.
1. Drift	50	0
2. Red marls with gypsum ...	500	0
3. Rock Salt (1st bed) ...	15	0
4. Salt and blue band	6	8
5. Rock Salt (2nd bed) ...	88	0
6. Blue and red band with some salt	17	0
7. Mixed salt, blue and red band	13	0
8. Rock Salt (3rd bed) ...	39	0
9. Thin blue bands	6	6
10. Dark-coloured rock	4	0
11. Freestone	10	1
12. Grey rock (not pierced through)	2	4
	751	7

At Eden the thickness of the bed of rock salt is ninety-six feet; of this about fifty feet is kept intact to form the roof, and the lower portion is worked, leaving large pillars to support the roof. Some of the beds are very pure, containing from 95 to 98 per cent. of pure salt of commerce.

The Jurassic System.

This system is represented in our counties by the lower formations only, while the Oolites are entirely absent. Our counties may claim to be unique in this respect, that it is only here that the Jurassic is represented in Ireland at all. As it is of interest to know what is absent as well as what is present, the table subjoined will accomplish this in the most comprehensive manner.

Oolite Formations.

Upper or Portland Oolite	Purbeck Beds Portland Beds Kimmeridge Clay	Absent.
Middle or Oxford Oolite	Corallian Oxfordian	
Lower or Bath Oolite	Great Oolite Series Inferior Oolite	

LIASSIC FORMATIONS.

Upper Lias	Absent.
Middle Lias	Present.
Lower Lias	
Rhætic or Infra-Lias	

The Rhætic and the Liassic beds of the north-east of Ireland attracted the attention of the late Professor Ralph Tate (the father of Naturalists' Field Clubs in Ireland), and his work on these beds is still our chief authority on the subject. His papers on these rocks were published in the *Quarterly Journal* of the Geological Society, vol. xx, p. 103; vol. xxiii (1867); vol. xxvi (1870). The Rhætic and Lias crop up in many places along the edge of the Antrim escarpment, but the following localities will be found most worthy of study: Colin Glen, Cave Hill, Barney's Point, Island Magee, Waterloo (one mile to the north of Larne on the shore), north of Garron Point in numerous landslips, White Park Bay, and Portrush.

A description of the section exposed at Waterloo will give an idea of the beds. Proceeding along the shore from Larne Harbour station, we pass over sands and gravels till we come to the shore entrance of Drumalis; between this and the bathing-box an exposure of Upper Keuper marls is to be seen below high-water mark; in places covered with gravels; the rocks are decidedly red in colour; north of the bathing-box they are cut through by a dyke, near which bands of gypsum may be observed in the marls. At the ladies' bathing-place the marls are blue-grey, again altering to red. The red stone is mottled with circular blue patches containing a hard nucleus. The footpath terminates against a cliff, in which a gradual transition to the White Lias or Rhætic can be traced. On the shore below Mr. Chaine's grave, thin bands of black shale occur with *Axinus;* the next band of shale yields numerous specimens of *Ammonites planorbis*, and the following band (about four inches thick) is crowded with *Ostrea liassica*. Passing the limekiln to a small bay, just south of some cottages on the shore, fine specimens of *Lima gigantea* may be found weathering out of blue Lias, while in the face of the bank above high-water

mark a band of Lias yields numerous specimens of *Gryphæa incurva.*

Other localities will be visited to fill up our information on these beds: for instance, the Rhætic exposed in the stream at foot of upper Colin Glen will yield many fish remains, teeth and scales—*Gyrolepis* and *Saurichthys apicalis.* Tate's measurements of the sections at this place are:

2. Dark-coloured shales and argillaceous limestones, with a few beds of sandstone at the base. In the shales are found *Axinus cloacinus*, *Avicula contorta*, *Cardium rhæticum*, *Pecten valoniensis*, etc. Thickness, eleven feet.

1. Black shales and clays, arenaceous shales, thin sandstones. In two of the thin arenaceous shales are fish remains—*Natica Oppelii*, *Trochus Waltoni*, *Avicula contorta.* Thickness, eight feet.

In the Lias of Barney's Point, vertebræ and bone referred to *Ichthyosaurus* are occasionally found. Robert Bell recently found the skull of an *Ichthyosaurus* in the Lias on the east shore of Island Magee. The Lias of Barney's Point is an argillaceous limestone, which readily alters on exposure to water into a tenacious blue-grey mud. In this mud many perfect specimens are found excellently preserved; notably, such common forms as *Cardinia Listeri* and *C. ovalis;* sections of ammonites, as *A. communis* and *A. Johnstoni*, are common; the sand in places is largely composed of fragments of Pentacrinites.

Frequent exposures of Lias are to be found along the coast road, where the plastic nature of the rock has given rise to many landslips in the past, of which a noticeable example is the slipped plateau on which Garron Tower stands. After every storm of rain small local slips may occur, so that in places the road is often rendered impassable in winter, particularly between Carnlough and Glenarm, and around Garron Point.

In White Park Bay, beds of Middle Lias occur (Ballintoy beds), containing *Ammonites Henleyi*, *Belemnites umbilicatus*, *Plicatula spinosa.* Occasionally sections of the Middle Lias may be found exposed along the banks of the small stream, but usually the strata are obscured under surface slips. The storm of 1896 stripped the sand from the shore in White Park

Bay, revealing the basement of Lias over a considerable area.

At Portrush, beds of Lower Lias occur on the shore near the ladies' bathing place. This rock has a classic reputation, as it was one of the arguments adduced by the Neptunists, about 1799, to prove the aqueous origin of the basalt. The rock is a dark indurated shale, breaking with a conchoidal fracture, frequently across the planes of lamination, so that in hand specimens it was easily mistaken for

R. Welch. *Photo.*

INDURATED LIAS SHALES, PORTRUSH.

basalt. It contains, however, numerous fossils—chiefly ammonites—along certain zones, but these are very difficult to extract, owing to the splintery nature of the rock. Similar rocks are to be observed in The Skerries, a small group of islands off the coast at Portrush. The unusual character assumed by the Lias in these localities is due to the hardening and baking produced by the neighbouring masses of basalt and dolerite.

Only the Lower and Middle beds of the Lias are represented in Ireland, the Upper Lias being absent; but it is

interesting to note that, among Lower and Middle Lias species occurring as derived fossils in boulder-clay in Co. Dublin, Messrs. Sollas and Praeger found one species of characteristic Middle Lias age.[1]

The Cretaceous System.

The rocks of this system are a very remarkable feature around the edge of the Antrim escarpment. In places the white chalk forms the strongest contrasts with the black basalt capping, and in other places, when found in juxtaposition with the red sandstones of the Trias, the colour contrasts are almost equally remarkable. Again, much of the variety of the scenery along the Antrim coast road is due to the faulting and slipping down of the strata, by which means the black basalt at times would seem, to the casual observer, to be interstratified with the chalk, as well as penetrated by the vertical dykes of black basalt which, in Eocene times, found numerous vents through long fissures in the white chalk.

The line of division between the basalt and the Chalk is so strongly defined as a horizontal line that any break in the continuity of that line is extremely noticeable. The frequency of such breaks strongly calls our attention to the numerous dislocations and fissures to which the crust of earth has been subjected in post-Cretaceous times; so that the county of Antrim is an admirable district in which to study the leading facts of dynamical geology. In some localities certain beds are absent which are prominent in others, suggesting investigations in the differential movements of the crust prior to the deposition of the Cretaceous rocks, or may allow us to reconstruct the hollows and heights of the ancient geography of the district in late Jurassic times.

In close proximity to Belfast, on the slopes of Squire's Hill, the following divisions of the Cretaceous system in descending order are to be observed :

5. White chalk.
4. Glauconitic chalk, or basement bed of white chalk.
3. Glauconitic sands and sandstones.
2. Yellow sands, grey marls, and sandstones.
1. Glauconitic sands.

[1] *Irish Naturalist*, vol. iv, p. 321, 1895.

The correlation of these beds with those in England and the Continent is shown in the annexed table:

Continent.	England.	Ireland.
Danian	Absent	Absent
Senonian	Upper white chalk, with flints	White chalk (5)
		Glauconitic chalk (4)
Turonian	Chalk, without flints	Absent
Cenomanian	Lower grey chalk	Glauconitic sands (3)
	Chalk marl	
	Cambridge green-sand	Glauconitic sands (1)
Albian	Gault	Absent

The Glauconitic Sands consist of a blue-green rock, rich in glauconite, showing evidence of having been formed in the interior of foraminiferal shells. In the Squire's Hill sections they preserve a uniform thickness of about five feet. The sands are characterized by *Exogyra conica;* other fossils found are *Lamna appendiculata*, *Belemnites ultimus*, *Exogyra lævigata*, *Pecten orbicularis*, *P. quadricostatus*, and *Ditrupa deformis*.

The Yellow Sands consist of buff-coloured calcareous sandstones, with chert masses and layers of soft brown sandstone, becoming at the base black and shaly. Fossils are fairly plentiful and in good preservation—*Ostrea carinata*, *Exogyra lævigata* var. *plicata*, *Pecten nitidus*, *Rhynchonella latissima*, *Cardiaster ananchytes*.

Glauconitic (so-called Chloritic) Sands and Sandstones. Dark green sands, almost made up of grains of glauconite; at the base of the section almost black; fossils are found, such as teeth and vertebræ of fish—*Exogyra columba*, *Ostrea semiplana*, *O. carinata*.

Glauconitic (so-called Chloritic) Chalk, the Basement Bed of the White Chalk, presents an interesting deposit of hard green chalk, with pebbles of quartz and large grains of glauconite scattered throughout the bed. Its fossil contents are chiefly sponges, with bands of *Ananchytes ovatus*. This interesting bed is evidently derived from the waste of an older bed containing large pebbles of rounded quartz, and characterized by an abundant fauna, chiefly fragments of

cephalopoda, urchins, and sponges. The following are a few species noted: *Belemnitella mucronata*, *B. quadrata*, *Pleurotomaria perspectiva*, *Echinocorys vulgaris*, *Holaster lævis*, *Ventriculites gibbosus*, and *Etheridgia mirabilis*.

The CHALK is a pure white limestone, with frequent bands of flint lying in flat tabular masses along apparent bedding planes; in some exposures vertical masses of flint of a roughly columnar appearance are to be seen—referred to as "Paramoudras."

The following is an analysis of the chalk from Magheramorne, by Dr. Hodges:

Carbonate of lime	98.63
Carbonate of magnesia	0.38
Phosphate of lime	0.10
Oxide of lime and alumina	0.08
Silica and insoluble clay	0.45
	99.64

The analyses published by Dr. W. Frazer Hume may also be referred to.

The chalk, as found in our district, is hard and compact, breaking with a splintery fracture, so that even hand specimens are somewhat difficult to dress; planes of bedding are not very evident, except where emphasized by the tabular flints. Fossils are not very numerous, with the exception of *Belemnitella mucronata*, which is found widespread throughout the district. The other forms are *Turritella unicarinata*, *Trochus* sp., *Ostrea vesicularis*, *Terebratula carnea*, *Rhynchonella plicatilis*. Occurring mainly in the lower portions of the limestone are *Mosasaurus gracilis*, *Echinocorys scutatus*, *Holaster planus*, *Pleurotomaria perspectiva*, etc. Microscopic sections of the chalk reveal the presence of a large number of foraminifera. The chalk powder found in the interiors of many of the paramoudras and nodular flints is a fruitful source of well-preserved foraminifera, and also of siliceous sponge spicules and ostracoda. The Appendix iii. to the *Proceedings* of the Belfast Naturalists' Field Club, 1875, may be referred to for "A List of the Cretaceous Microzoa of the North of

Ireland," by Joseph Wright, F.G.S., also the Appendix to the year 1884-85.

The chalk has been much indurated by the basaltic flows of Tertiary times. In some places, where in contact with the sides of a basaltic dyke, it presents a crystalline structure, and is often stained a light ochreous colour.

The Tertiary Period.

After the deposition of the Cretaceous rocks, our district underwent a period of elevation. The bottom of the Chalk sea was elevated and became dry land, subject to sub-aerial denudation. Consequently, the upper surface of the Chalk is found to have been weathered, the softer calcareous material has been washed away, leaving many flint nodules embedded in an ochreous clay as an evidence of the amount of denudation which the Chalk has been subjected to before the outflows of basalt. This red ochreous material might well be compared with beds of similar character which occur in many parts of the country between the various basalt flows. An excellent example may be seen in the old chalk quarry at Whitehead, where the irregular form of the upper surface of the Chalk seems to indicate the sides of an old river valley. The flints are of a deep red colour, induced by the heat of the thick, deep lava flow. The only fossils recorded from this band are redeposited Chalk fossils. Over this old land surface numerous sheets of basic lavas were outpoured in early Tertiary times. During the periods of quiet, between the successive outflows of igneous material, the surface of the lava flow was subjected to denudation, a scanty soil was formed, vegetation got a footing, only to be submerged in the next flow. Remains of such vegetation are to be found in a well-defined band forming the division between the lower and the upper basalts. The band consists of volcanic tuffs, clays, conglomerates, thin lignites, and pisolitic iron ore. At Ballypallidy this seam has yielded abundant remains of plants—*Pinus*, *Salix*, *Populus*, *Acer*, *Quercus*, etc. At Ballintoy lignites are found.

Mr. Starkie Gardner considers these remains indicate the same horizon as the Bournemouth beds; that is, they belong to the middle Eocene period.

The Pleistocene Period.

Glacial Deposits.—Our district presents many problems for the glacial geologist. Boulder clay is widely distributed over the surface of the country. Fine sections of these clays are exposed in the numerous brickfields around

J. St. J. Phillips. *Photo.*

CONEY ISLAND.
Sections of Boulder Clay overlain by Consolidated Sands and Gravels.
Glacial Striæ on Rocks in foreground.

Belfast. The clay rests upon intensely glaciated rocks; the Cretaceous rocks of Antrim and the Ordovician shales of County Down retain the polishing and scoring in great perfection. The division into upper and lower boulder clay, with the intermediate sands and gravels, is not always apparent; often only one division being visible. The clay is typically red, tough, unstratified, and laden with erratics well rounded and scored, of all dimensions, from great blocks of chalk and basalt down to tiny pebbles, which have often travelled long distances from their parent locality.

In different districts the texture varies considerably, some clays containing a good deal of sand, probably derived from the Trias. Interesting deposits of stratified sands and gravels are numerous in the Dundonald valley in County Down; even more extensive deposits are to be found at Antrim, Killagan, and the Carey river valley in the County Antrim. The study of boulder clay and erratic blocks has occupied the attention of members of the Belfast Naturalists' Field Club for a considerable period, and the footnote gives references to their publications on the subject.

Scotch erratics are fairly common in our drift; the fragments of riebeckite eurite from Ailsa Craig (?) are almost ubiquitous. Many igneous rocks of Antrim are easily identified, and have furnished valuable evidence of the direction of ice-flow, generally from N.E. to S.W.

Some of the erratics from Antrim are of considerable size, such as the "Butterlump" Rock, on the shores of Strangford Lough. Shells occur occasionally in our glacial deposits and usually in broken fragments, except in a few places, such as Woodburn, where the valves of the delicate *Leda* were found still in juxtaposition. Foraminifera and

---

S. A. Stewart, F.B.S.E.—The Mollusca of the Boulder Clay of the North-east of Ireland. Appendix to *Proc.* B.N.F.C., 1879-80.

Jospeh Wright, F.G.S.—Post-Tertiary Foraminifera of the North-east of Ireland. Appendix to *Proc.* B.N.F.C., 1879-90.

Miss S. M. Thompson.—Report of the Geological Committee. *Proc.* B.N.F.C., 1893-94. *Ibid.* 1894-95, 1895-96, etc.

R. Ll. Praeger.—Bibliography of Irish Glacial and Post-Glacial Geology. Appendix to *Proc.* B.N.F.C., 1895-95.

other marine microzoa have been found in clays at considerable altitudes above sea-level; at 450 feet on Carnmoney Hill and the Knockagh; 800 feet at Wolfhill; and in two interesting little patches of stony clay at heights of 1,100 feet on the Cave Hill, and 1,300 and 1,400 on Divis Mountain. It is noticeable that these two last beds apparently contained no far-travelled erratics, basalt, chalk, and flint fragments only being found in them.

R. Welch. *Photo.*

THE "BUTTERLUMP" ROCK.

The close of the Glacial period leaves its records in many eskers and in the local moraines of the Mourne mountains, where these moraines have blocked up the ends of the valleys, producing lakes, which in time may have got filled up, giving us such flats as are found in the Happy Valley. At the foot of many valleys of the Mournes the glacial drift has been spread out as a fan talus, as in the valley above the Bloody Bridge.

RAISED BEACHES are common features along our coast at varying heights. Occasionally the old sea-cliffs and sea-stacks may be distinguished. Mr. Praeger considers that

the raised beaches and the upper estuarine clay are contemporaneous.[1]

Raised beaches.
Upper estuarine clay.
Lower estuarine clay.
Submerged peat.
Sands and gravels.
Boulder clay.

ESTUARINE CLAYS are found under much of the low-lying area of the city of Belfast. The various works done by the Harbour Commissioners have exposed thick beds of these clays. In their lower portions they are of a littoral character, but in the upper portions are found many shells which live in depths of five to ten fathoms. These clays have yielded an abundant fauna, many of the species attaining remarkable dimensions. The deposit is a tough blue clay; under water it readily becomes a pasty mud; so that in the city, where the clay occurs, piles about forty feet long have to be used in forming foundations.

Similar deposits are found in Larne Harbour, notably at Magheramorne, and in almost all the bays in the north-east of Ireland.[2]

The peat bed contains remains of the Great Irish Deer, well-preserved plant remains, such as hazel, alder, oak, sedges, etc., and elytra of beetles. Resting on the peat is the lower or *Scrobicularia* zone of the estuarine clay, with a littoral shell fauna; the upper estuarine clay deposited in deeper water yielding *Thracia convexa*.

The sands and gravels of the Lagan valley are in many cases redeposited glacial deposits, owing their present position to the damming up of the drainage systems at the close of glacial times. Near the Ormeau Bridge fine sections have been exposed in the Annadale and other brickworks, while the eskers at Lisburn are the remains of englacial deposits contemporaneous with the gravels and sands of the valley above noted.

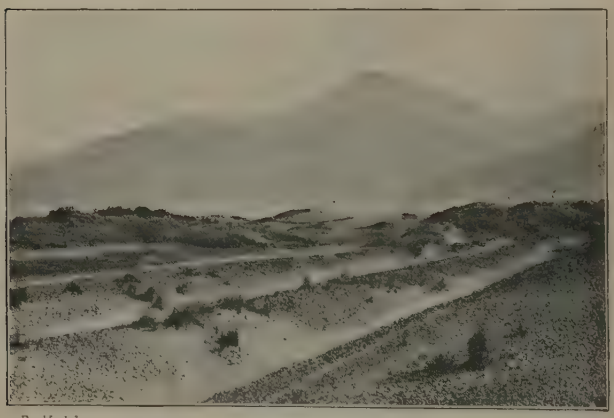
---

[1] PRAEGER.—Raised Beaches of N.E. of Ireland. *Proc.* Royal Irish Academy, 3rd series, vol. iv, No. 1 (1897).

[2] Estuarine Clays of the N.E. of Ireland. *Ibid.*, vol. ii, No. 2 (1892).

The alluvial deposits of the river Bann yield diatomaceous earth in large quantities at Toome and at Portglenone. The kiesulguhr works of Mr. Grant at Toome are of considerable interest and importance. Diatomaceous earth is also found at Lough Mourne, above Carrickfergus. Shell marls are found in various localities, as at Ballyfinder, near Portaferry.

Extensive sand dunes are found at Portrush, Bushmills, White Park Bay, in County Antrim, and at Newcastle, and around the shores of Dundrum Bay, County Down. These dunes and the raised beaches are among the archæologist's



R. Welch. *Photo.*

ANCIENT STORM BEACHES, NEWCASTLE.

Occurring under Sand Dunes, in which are found Flint Implements, Kitchen Middens, and Primitive Pottery.

hunting-grounds for the remains of primitive man: kitchen middens, old refuse heaps of shells, bone and charcoal, pottery, flint implements, flakes and cores, are of frequent occurrence in these localities.

Bogs are widely distributed over the higher grounds of Antrim; and associated with the bogs the remains of old lake-dwellings, or crannoges, are not infrequent. Some of these have been systematically explored, with the result that stone and bronze implements, glass beads, bronze and

even gold ornaments have been unearthed. Many of these objects, alas! find a final resting-place, like Irish exiles, far from home, instead of in well-organized local museums.

IGNEOUS ROCKS.

THE province of Ulster is extremely rich in the variety of igneous rocks which it contains; our counties of Antrim and Down presenting many problems worthy of the petrologist's attention. In Antrim extensive lava flows of Tertiary age cover most of the plateau. The outpourings of this period are not confined to the basic types alone; the acid type of igneous rock is also represented by the rhyolites of Tardree and certain districts north of Ballymena. In the granites of Down we have a rock that is of considerable economic importance: a portion of this granite is of undoubted Tertiary age, while another portion is certainly of much greater antiquity. The dykes and sills of the Ards peninsula also contain many Intermediate type of rocks, such as lamprophyres or mica-traps; while in the andesites of the coast south of Newcastle we have the Intermediate igneous rocks with plagioclastic felspars. There are considerable difficulties encountered in attempting to deal with the igneous rocks in their historical sequence, as in many localities the age of the rocks cannot be determined except within very wide limits: for instance, over the wide Silurian uplands of Down we constantly meet with igneous intrusions which we may broadly say are post-Silurian, but in many places in this county where these igneous rocks occur we have no representatives of the sedimentary type of later age than the Silurian by which we can delimit the age of the igneous rocks in question: therefore we propose to deal with the rocks according to a petrological classification.

Igneous rocks may first be roughly classified, according to the percentage of silica which they contain, into Acid Rocks, Intermediate Rocks, and Basic Rocks. These three great divisions may be further qualified, according to the degree of crystallization which the rocks present, into holocrystalline, microcrystalline, and glassy groups. These groups in turn may present varieties in composition or in the degree of crystallization which they present.

THE ACID ROCKS.

Rocks of this type are exposed in Down in the Mourne mountains, and in a long strip of country extending from Newry through Rathfriland to near Ballynahinch; in Antrim they occur at Tardree Mountain, and in some smaller areas

J. St. J. Phillips. *Photo.*

QUARRY, TARDREE MOUNTAIN.

north of Ballymena. On Sandy Braes, near Tardree Mountain, occurs the glassy variety of acid type known as pitchstone.

As well as the above localities, where the rocks are developed on a large scale, there occur many smaller exposures of acid intrusions, as in the rhyolitic intrusions in the granite of Castlewellan. At Tornamoney, about two miles north of Cushendun, there is a considerable exposure of eurite.

Granite.

The granites of the Mourne mountains are easily accessible from Belfast, and the district is one offering much variety of scenery. For the various routes that may be chosen in making excursions through the district, the Guide published by the County Down Railway Company should be referred to for reliable information and suggestions.

The granite of the Mournes is an excellent example of an acid intrusion or boss raising on its shoulders large masses of Ordovician and Silurian rocks. These Silurian rocks have subsequently been denuded from the higher peaks, leaving the granite core exposed. In many places large areas of the Silurian rocks are still left of considerable thickness and at high elevations; and in such rocks we find a number of dykes which give us a suggestion as to the age of the granite mass. Such Silurian remnants may be seen on the top of Thomas Mountain on the flanks of Slieve Donard, on the cap of Finlieve (1,888 feet high), and on Slievemaganmore. These isolated patches are not the only Silurian rocks to be found at considerable elevations, for other Silurian rocks *in situ* may be found at even greater elevations, as in the spurs dominating the Deer's Meadow. Hence we may infer that the uplift affected a wide area, and that these patches are the remnants not yet removed by denudation. The intrusion of the granite has altered the shales, baking and contorting them, so that small specimens may often be found showing the crumplings of the strata very clearly.

In the patches above referred to, some of the dykes have intruded before the uplift of the mass, so that the whole

mass of both the dykes and Silurians is found resting on the intruding granite; we find in other places that both the granite and the earlier basic dykes are penetrated by another set of basic dykes of a later age. Similar periods of activity are found in the County Antrim, where we find the basalts divided into lower basalts and upper basalts, with an intermediate development of acid rocks. The Antrim series are referred to as of Eocene age, and the Mourne series may be considered as being of the same age.

R. Welch. *Photo.*

THE CASTLES OF KIVVITAR (MOURNE MOUNTAINS).

Characteristic examples of the weathering of the granite along its joints may be seen in the "castles" of Commedagh, which present the appearance of cyclopean masonry on the face of the cliffs or in the jointed pillars of granite. The texture of the granite varies much, in places being coarsely crystalline, in others being of finer texture. Drusy cavities are frequently met with in which excellent crystals of quartz, felspar, and mica are generally found; less

common are blue-green beryl, topaz, and colourless amethyst, much sought after by mineralogists and collectors.

Along the coast, to the south of Newcastle, numerous dykes of varied composition occur in uptilted Ordovician strata. Noted examples are the ones of eurite, just north of Bloody Bridge, at Green Harbour, and at Glasdrumman Point. Many of these dykes are composite. The one at Glasdrumman has been described by Professor Cole.[1] In this example we find an original dyke of basaltic andesite, with an intrusion of eurite. Veins of eurite penetrate the basalt; in places the basalt has been re-fused, and allowed the floating of crystals of quartz and orthoclase into the basalt. Lumps of the basalt, containing red orthoclase floated in, have been floated into the eurite along margins. The width of this dyke is given at one place as composed of two margins of basalt 17 feet and 4 feet respectively, with a central intrusion of eurite 37 feet wide. In another dyke south of Bloody Bridge the eurite approaches a rhyolite in flow structure.

The Newry Granites.

In the granite of the Newry district we have a rock of greater antiquity than the Mourne granite, though not yielding such picturesque scenery. The rock is later than the Silurian but older than the Carboniferous limestone; it represents the core of an uplift of lower Old Red Sandstone times, and is thus of same age as the granites of the Leinster district. The Newry granite is a grey, fine-grained rock, free from the large porphyritic crystals of felspar and from the large flakes of mica that characterize the Leinster granite.

The Acid Rocks of Antrim.

The exposures of rhyolite at Tardree present many types of rocks, from the massive pink lithoidal rhyolite to the black glassy obsidian.[2] The area occupied by the rhyolite in the Tardree district is about ten square miles, but sections are not well developed except in a few places.

---

[1] *Scientific Trans. Roy. Dub. Soc.*, vol. v. (series ii), August, 1894.

[2] Prof. Cole.—The Rhyolites of the County Antrim. *Sci. Trans. Royal Dub. Soc.*, vol. vi (series ii), May, 1896.

The district generally is covered with drift and bog, so that the relations of this rock to the basalts, or the exact extent of it, are somewhat undetermined from direct field observations. The main exposure of the rock is to be found in the quarry on the south side of Tardree Mountain; here the rock shows a well-marked columnar structure, which readily allows of quarrying operations. It is used locally for building purposes, the smaller blocks being for paving. The rock is here of greyish colour, is compact in character, free from fluidal or banded structure, but contains many porphyritic crystals of glassy sanidine, plagioclase, quartz, occasional mica, and much trydimite. The quarry to the north-east of Tardree Mountain is less compact in the character of the rock; bands of brown and green traverse the rock sometimes along evident cracks parallel to the banding.

The rocks exposed on the hillsides to the south-west at Carnearny are fluidal rhyolite and spherulitic obsidian traversed by perlitic cracks.

Sandy Braes is not located on the smaller scale maps, but may be easily found by leaving the main road from Doagh to Kells just opposite the Tardree inn, and taking a by-road to the east. Close to this is a large surface excavation in pink and bluish rhyolite, well banded and with well-marked planes of flow. The rock breaks up readily, and decomposes along the numerous small and irregular joints, so that the quarry is used for the supply of gravel. Going further east the roadside heaps yield many weathered specimens of fluidal obsidians, weathering to a dull grey colour. Surface excavations through the fields and along the drainage lines will give the only opportunity of seeing the rock *in situ*. Near the top surface the obsidian weathers to a fine gravel, but further down many large blocks of brilliant and compact obsidian are readily found. The openings are too small and sporadic to be located for permanent reference, but from their abundance many different varieties of acidic material may be collected.

Other exposures of rhyolite occur at Eslertown, Kirkinriola, Cloughwater, to the north-west of Tardree, while to the south-east there was a fine section visible in a quarry at Templepatrick. Of their composition Professor Cole says:

"The rhyolites of the County Antrim are as a rule poor in ferromagnesian constituents, but the occurrence of these minerals divides the rocks into two groups, the biotite rhyolites, such as those at Templepatrick, Kirkinriola, and Ballycloughan, and the augite rhyolites, represented on Carnearney and Sandy Braes. All the types, whatever their structure, are fairly rich in porphyritic constituents, with the exception of the fluidal rhyolite of Cloughwater."

The only section from which evidence may be directly observed is the quarry at Templepatrick. In this the rhyolite is intrusive between a mass of basalt and Chalk; but it is insufficient to give us data for determining the exact age and nature of the flow. In many of the beds, between the upper and lower basalts, rounded and travelled pebbles of rhyolite are found, notably at Glenarm and Ballypallidy. These intermediate beds—containing iron ore, bauxite, and plant remains—at Ballypallidy represent a considerable interval of time, during which the rhyolite came to be exposed at the surface, either by a direct extrusion of volcanic material in this interval, or by laying bare by denudation of some intrusive masses of Lower Basalt age.

The exposures of rhyolite occurring close on a line with north-west and south-east trend, might lead one to imagine that they were all connected with one fissure system, and that they are at least bosses or small laccolites at points of weakness; but the variety of the material found within easy range of Tardree would seem to indicate that this hill is the denuded core or plug in a vent, the materials from which found their way as a lava-flow over the surrounding district.

The Quartz Felsite of Cushendall.

This rock is found chiefly in the area south of Cushendall. Many exposures are seen in small quarries from which road metal is taken. Here the rock is found to be of reddish brown to a purplish colour, and in sections on the shore near Limerick Point it is of pale buff colour, with bands of red jasper irregularly disposed through the joints. The rock has a fine grained ground mass, containing minute felspar crystals, but with abundant porphyritic crystals of orthoclase and less frequent quartz and brown mica. The large crystals

stand out as clear bright blebs against the dull ground mass in a hand specimen.

The age of the rock is not definitely determined, but from the fact that numerous well-rounded and worn fragments of it are found in the Old Red Sandstone to the north, it is evident that it is earlier than the conglomerates of Cushendun.

Cushendun.

Another exposure of acid rock is found to the north-east of Cushendun, and in sections exposed along the road above Tornamoney Point. The base in this case is fine-grained granitic, with numerous large crystals of felspars, which in hand specimens often show the crystal forms in perfection. In micro-sections the orthoclase crystals are found to be beautifully zoned, and the rock contains well-defined crystals of plagioclase. Biotite also occurs, sometimes altered to a green chlorite.

The eurite of Cushendun has been found very frequently in the boulder clays to the south of the district, and from its widespread distribution as an erratic, it is evident that the exposures of this rock must have been of considerable extent. *In situ* the rock occurs among the crystalline schists, and may be considered the plutonic representative of the quartz porphyry of Cushendall.

The Lamprophyres of the District.

Dyke rocks belonging to this group of igneous intrusions are especially numerous in County Down. The Ards peninsula on the east of County Down contains several hundred dykes belonging to the Lamprophyre group, and similar dykes occur, but less frequently, in the inland area. The dykes occur for the most part along the bedding planes of the steeply tilted Silurian sediments, and only in relatively few instances are seen to cut across these rocks. This mode of occurrence renders their recognition in the field a matter of some difficulty, as the dykes very closely resemble the harder grit bands associated with the Silurian shales. This is especially the case in the south of the peninsula, but in the more northern examples the dykes weather less readily than the sediments, and thus stand out boldly above the

general level. The dykes vary much in width, ranging from a few inches to three or four feet. They occur straight, sinuous, and occasionally branched. They run more or less N.E. and S.W., and in this particular they differ from the basalt and dolerite dykes of Tertiary age, which run in directions practically at right angles to the dykes now under consideration. These dykes are clearly later than the Upper Silurian rocks, into which they are intrusive, and also later than the period of the earth movements which tilted the rocks on end. If the dykes may be considered to have their origin from the same acid magma as the granites of the Newry and Castlewellan range, then the conclusion is that the dykes are of Lower Old Red Sandstone age. Two main types are predominant—camptonite and kersantite—but various intermediates occur. Special types are not confined to distinct areas as a rule, but frequently the different varieties alternate with one another over an extended tract of country or shore line. Microscopical examination of the rocks reveals the fact that the great majority are considerably altered notwithstanding their fresh appearance in the field. This is specially true of the felspathic constituent, which is very often entirely replaced by calcareous and other secondary material. The coloured constituents are much less altered and occasionally quite fresh.

H. J. Seymour, F.G.S., in the *Geological Magazine*, June, 1900, has described a dyke which occurs in South Bay, three miles south-east of Portaferry, containing a secondary blue amphibole (arfvedsonite), this being the first recorded locality for the mineral in Ireland. The rock itself is a hornblende kersantite, containing as essential minerals biotite with subordinate green hornblende, plagioclases considerably altered with various inclusions, and as accessory constituents apatite, a blue amphibole, chlorite, and secondary calcite replacing hornblende. The blue amphibole occurs mostly as a secondary addition to, but partly also as a replacement of the primary green hornblende, and has grown in crystallographic continuity with it.

County Antrim has not many representatives of the intermediate rocks, but a fine dyke of camptonite at Rue Bane Point, east of Murlough Bay, deserves to be noted. It is

about four feet wide, and rises through the schists. Being of a dark brown colour, it is readily distinguished from the containing rock. In it are found crystalline hornblende and biotite, in an altered felspathic base.

BASIC ROCKS.

The chief development of this type is to be found widely distributed over the county of Antrim in massive sheets; the same type is also found occurring as dykes and sills in both Antrim and Down. Perhaps the best locality for the study of the mode of occurrence is to be found at Scrabo Hill, near Newtownards; here the hill has been dissected out in quarrying operations to such an extent that the connection between the dykes and sills and the overlying basalt is very apparent. Basic dykes have been referred to as cutting through the granite of the Mourne mountains.

The BASALTIC LAVA FLOWS may be divided into Lower and Upper series. Between the two series occur those beds of iron ore and bauxite that are of considerable economic importance. In many places this interbasalt series is of interest to the palæobotanist as containing leaf beds, as at Ballypallidy, or lignites, as at Ballintoy and other places: it is from the character of the flora found here that the age of the basalts may be determined, as well as by correlating the series with the basalt flows of the western islands of Scotland. The thickness of these interbasalt beds in many places, the nature of the material of which they are composed, the presence of rolled and water-worn pebbles of lower basalt, and the widespread occurrence of rhyolite far removed from any known extrusions of this rock, indicate the fact that a considerable interval of time elapsed between the flows constituting the Upper and Lower sheets. In this interval vegetation had established a footing, and in the old valleys formed on the surface of the Lower basalt sheet, lakes and marshes provided a collecting-ground for the plant remains referred to.

The two main divisions or sets of basalt flows have themselves been built up of similar minor flows, each differing from the succeeding or the earlier one in texture and

crystallization, and marked from the others by the presence of similar ochre and bole beds of much smaller dimensions.

We find the first flows of the Lower basalt overlying the Chalk or earlier rocks in all cases. The surface of these earlier rocks have been denuded and weathered; in many places pockets in the earlier rocks contain flints and other nodules which have been weathered out; these flints are much altered in colour; the surface is coated with brown ferruginous matters, and the body of the nodule has been converted from the blue grey of the Chalk flints to reds and browns through metamorphic action. In certain places, as in the quarry at Whitehead, an old valley section on the surface of the Chalk is exposed. On this land surface the first outflow of basalt occurred, charring the scanty covering of chalky soil that had disintegrated from the main rock. The outlets for this lava material are to be found in the numerous fissures in the Chalk and other rocks; these fissures are now filled with basic lava and widely known as dykes. As well as the effusions from fissure eruptions, an amount of material was derived from volcanic centres. The necks of at least four such volcanoes are to be traced at Carnmoney, Scawt Hill, Tiveragh, and Slemish, while at Carrick-a-Raide, near Ballintoy, the agglomerate and tuffs indicate a fifth eruptive centre.

Excellent specimens of these minor flows are to be seen in the many sections along the Antrim headlands. At the Gobbins cliff, east of Island Magee, the various flows are seen clearly differentiated from each other. Some of the sheets are compact and massive black basalt; others are vesicular and amygdaloidal, often containing in their cavities zeolites and other secondary products. The zeolites are frequently drawn out in the direction of the flow, indicating a considerable degree of movement during the formation of the vesicles. Other flows are traversed by a number of vertical joints, and approach to rudely columnar basalt. The flows differ in the degree of crystallization of the various minerals, indicating different rates of cooling and different conditions under which the magma cooled. Frequently one flow is marked off from the next by a band of red ochre, the remains of a soil weathered from the surface of the older

sheet. At Ballygally Head the great height of the rude columns known as "cornsacks" indicates a considerable thickness or depth in the sheet, and the coarse texture of the rock accompanying this proves how variable in thickness were the various flows. At Pleaskin Head and

R. Welch. *Photo.*

THE GOBBINS, ISLAND MAGEE.
Minor Flows, with Intermediate Bole Beds.

the Causeway the columnar structure is remarkably developed in the lower part of a flow, while the upper part, which has cooled more rapidly, shows the characteristic "starchy" structure. Spheroidal structure is common, and when weather has attacked the surface it brings out the structure known as "onion" structure.

As the same structures are common to the Upper and Lower basalts, and as there is no fixed lithological difference between the Upper and Lower sheets, it is impossible to determine to which group an isolated specimen may belong: it is only by tracing the field relationships of the rocks that a determination can be relied upon.

The various degrees of crystallization allow of distinguishing the rocks into coarse dolerite or gabbro; true basalt; and on the margins of dykes or on the under surfaces of flows, as at the Rathkenny mine, the glassy type (tachylite) may be found. In the dolerite the olivene appears to have consolidated first in the form of irregular grains; plagioclase felspar forms a meshwork in which augite has subsequently crystallized in large ophitic masses. This order of crystallization is, however, not constant.[1]

Sir Archibald Geikie has described the "segregation veins" occurring in the dolerite of Portrush and Fair Head: "These veins or seams differ from the rest of the rock mainly in the much larger size and more definitely crystalline form of their component minerals."[2]

Basic Rocks, County Down.

Beyond the exposure of basic rock at Scrabo (ophitic olivene dolerite), and a similar but smaller mass at Dundonald railway station, the exposures of basalt in County Down are confined to the dykes, which in some districts are very numerous and noteworthy. At St. John's Point, near Ardglass, dykes occur along the shore, some of fine-grained basalt, with large porphyritic felspars retaining their crystalline form and structure unaltered. The two fine dykes, between tides, just south of the Lighthouse, show this very clearly.

---

[1] Professor Judd on "Glomero-Porphyritic Structure," in *Quart. Journal Geol. Soc.*, xlii (1886).

[2] *Volcanoes of Great Britain*, vol. ii, page 300 *et seq.*

The basalt dykes of the Mourne district have already been referred to. The Geological Survey, in a note on their map referring to the shore line south of Newcastle, records as many as 140 dykes in $1\frac{1}{4}$ mile of coast. Many of these are andesites, some are composite with later intrusions of eurite, while two dykes of variolite half a mile north of Annalong, and one dyke $2\frac{1}{2}$ miles south of Annalong, have been described in detail by Prof. Cole.[1]

BOTANY.

By Henry Hanna, R. Lloyd Praeger, and Rev. C. H. Waddell.

FLOWERING PLANTS AND VASCULAR CRYPTOGAMS.

In order that the character and distribution of the flora may be understood, brief reference must be made to the physical features of the area. Down and Antrim occupy the north-eastern corner of Ireland, and form the portion of that country nearest to Scotland. The district is colder than Donegal, which adjoins on the north-west, where the warm influence of the Atlantic is felt to a marked degree. The waters of the North Channel and Irish Sea, which wash the shores of Antrim and Down, constitute the coldest marine area in Ireland. The extent of the district is 2,148 square miles (Down, 957; Antrim, 1,191). The coast-line is extensive and varied. Rivers and lakes are fairly represented. The district borders on Lough Neagh, which brings some very rare plants into the flora. Mountains are also well in evidence, the basaltic plateau of Antrim providing extensive high grounds, though no point rises above 1,817 feet; while in Down the granite peaks of the Mourne Mountains form a salient feature, the highest summit reaching 2,796 feet. Low-level peat-bogs of considerable size occur in Antrim, but are now almost cleared away in Down; mountain bog is present in plenty.

[1] *Sci. Proc. Roy. Dub. Society*, vol. vii, N. S., part 5. *Geolog. Mag.*, April, 1894.

Down and Antrim rank among the best-known counties so far as plant-geography is concerned. This is mainly the result of the researches of S. A. Stewart, who for forty years has studied the local flora. Among other botanists whose researches have contributed chiefly to the sum of our knowledge should be mentioned John Templeton, Ralph Tate, George Dickie, David Moore, and T. H. Corry.

It should at once be pointed out that Down and Antrim do not form a natural botanical province. The Eocene basalt plateau of Antrim and East Derry has a flora of its own, including certain alpine and Scottish species, and also some calcicole plants. The low grounds, formed of Silurian slates, which on the other hand prevail over the greater part of Down, are poorer in these groups; the Down flora is allied to that of Armagh and Monaghan, where a similar surface and similar rocks prevail. The most remarkable phyto-geological feature of Ireland as a whole is the great area of limestone which occupies the middle parts of the island. In Down and Antrim we are beyond the range of this rock. Down is devoid of calcareous rocks, while in Antrim the small exposures of hard Chalk do not much affect the flora; but the basalt provides for some species a substitute.

The total number of Flowering Plants and Higher Cryptogams found in Down and Antrim is 820,[1] as compared with 1,020 species in Ireland. These figures, and others which follow, do not include segrates, such as the Brambles or Eyebrights. Analyzing this total according to the "types of distribution" adopted by H. C. Watson to express geographic range in Great Britain, we find that the bulk of the flora is made up of plants of "British" type—species which range throughout Great Britain. Of "English" type plants, Ireland possesses 91 undoubtedly native species. Of these, 46 occur in Down and 47 in Antrim, the average number in an Irish county-division (according to present knowledge) being 37. This apparent richness in "English" plants is,

[1] The list of Irish plants which is adopted as a standard in the matter which follows is that given in *Irish Topographical Botany*. The statistics are derived from the same source, brought up to date, sub-species being not reckoned.

however, probably due rather to our complete knowledge of the flora as compared with much of the rest of Ireland, and to the fact that many of the species in question are plants of the sea-coast, of which there is a wide and varied extent in our district, than to climatic influences. In northern plants—Watson's "Scottish" and "Intermediate" types—the district is comparatively rich. Ireland contains 62 species out of 98 in England and Wales; and of these 62, no less than 47 are found in our area—33 growing in Down and 46 in Antrim. To briefly compare next the plants of eastern and western range in Great Britain—Watson's "Germanic" and "Atlantic" types. Ireland is well known to be very poor in "Germanic" plants, yielding only 12 out of 102 in England and Wales; and of these 12, our district possesses but four—namely, ‡*Galium erectum*,**Crepis biennis*, *Polygonum mite*, *Orchis pyramidalis*—and only the last two of these can be classed as natives. Of "Atlantic" plants, Ireland has 35 out of 62 in England and Wales. Of these 35, our district yields 21, 18 growing in Down and 19 in Antrim.

The present writer has recently proposed[1] a series of "Types of Distribution" for Ireland, on the lines of those employed by Watson for Great Britain. These are—

Central ... plants seen chiefly in middle Ireland.
Marginal ... plants seen chiefly around the margin.
Ultonian ... plants seen chiefly in northern half of Ireland.
Mumonian plants seen chiefly in southern half of Ireland.
Lagenian ... plants seen chiefly in eastern half of Ireland.
Connacian plants seen chiefly in western half of Ireland.

Analyzing our flora according to the lists given of these types, we find that of Central plants 13 out of 38 species occur in the district—9 in Down and 6 in Antrim. Three of the 13 are confined to Lough Neagh, and five to the Ardglass district. Of Marginal plants, out of a list of 46 species, the only ones absent from the district are *Subularia aquatica* (formerly present), *Trifolium fragiferum*, *Carex rigida*, *Chara canescens*. Ultonian plants find their focus in

[1] PRAEGER: On Types of Distribution in the Irish Flora. *Proc.* R. I. Academy, xxiv, Section B, No. 1, 1902.

Antrim, which contains 37 out of 45 species, Down falling considerably below this number. Of Mumonian plants, on the contrary, out of 66 species only 9 are in our district, of which 8 are confined to Down, and the remaining 1, *Carex muricata*, to Antrim. Of Lagenian or eastern plants we have a good representation, 28 species occurring out of 49, while the Connacian or western group of 63 species is represented by only 8 plants.

Certain plants which are widely distributed in Ireland are absent from the north-east. These are species which are characteristic of the south, west, or centre of the country, and many of them have a distinct preference for a limy soil. The most remarkable absentee is the Cowslip, found in almost every county in Ireland except those of the north-east, in which it occurs only as an escape from cultivation. A few of the other most conspicuous absentees are listed below: the number appended to each shows in how many of the 40 Irish county-divisions it is known to occur:

Lastrea spinulosa	... 34.	Orobanche Hederæ	... 24.
?Gentiana Amarella	... 29.	Tragopogon pratensis	... 22.
*Linaria minor	... 27.	Festuca Myuros	... 22.
Ophrys apifera	... 26.	Centaurea Scabiosa	... 21.
Chlora perfoliata	... 25.	Orchis Morio	... 20.
Leontodon hispidus	... 24.		

To ascertain the commonest British plants absent from the district, we have recourse to the list of species arranged in order of frequency in *Cybele Britannica*, iv, 234. Of the first 300 species, all grow in our district. Of the fourth hundred, five are wanting, of which one, *Genista anglica*, is absent from Ireland:

Genista anglica.	Gentiana Amarella.
Ornithopus perpusillus.	Primula veris.
Tragopogon pratensis.	

Of the fifth hundred, eight are wanting, of which the four first enumerated are absent from Ireland, at least as natives:

Ranunculus hirsutus.	Corydalis claviculata.
Helianthemum vulgare.	Centaurea Scabiosa.
Ononis spinosa.	Calamintha Acinos.
Calamintha Clinopodium.	Galeopsis Ladanum.

The flora of the district, as already stated, numbers 820 species, in accordance with the basis adopted. Of this total, Down possesses 752 species and Antrim 778. In other words, 710 species occur in both counties; 42 Down plants are not found in Antrim, and 68 Antrim plants are unknown in Down. An enumeration of these last two groups will supply a useful comparison of the flora of the two counties:

Down Plants not in Antrim.

Ranunculus circinatus.
*Papaver somniferum.
†P. hybridum.
Glaucium flavum.
Fumaria confusa.
*Barbarea præcox.
Brassica alba.
Elatine hexandra.
E. Hydropiper.
†Vicia tetrasperma.
Saxifraga stellaris.
Drosera intermedia.
Crithmum maritimum.
†Galium Cruciata.
Dipsacus sylvestris.
Erigeron acre.
‡Artemisia Absinthium.
Saussurea alpina.
Hieracium senescens.
H. argenteum.
Andromeda Polifolia.
‡Hottonia palustris.
Cynoglossum officinale.
Linaria repens.
*Orobanche minor.
‡Verbena officinalis.
Atriplex portulacoides.
*Iris fætidissima.
Juncus obtusiflorus.
Ruppia rostellata.
Carex paludosa.
Glyceria aquatica.
Chara contraria.
C. hispida.

Antrim Plants not in Down.

Thalictrum flavum.
Ranunculus fluitans.
R. penicillatus.
*Erysimum cheiranthoides.
†Reseda lutea.
Cerastium arvense.
Arenaria verna.
Sagina subulata.
Hypericum hirsutum.
Geranium sylvaticum.
G. pratense.
Geranium lucidum.
Rhamnus catharticus.
‡Melilotus officinalis.
*M. arvensis.
Vicia Orobus.
Lathyrus palustris.
Dryas octopetala.
Poterium Sanguisorba.
Saxifraga Hirculus.
S. aizoides.
S. hypnoides.

Parnassia palustris.
*Sedum album.
*S. rupestre.
Myriophyllum verticillatum.
Carum verticillatum.
Sium latifolium.
Chærophyllum temulum.
*Peucedanum sativum.
Adoxa Moschatellina.
Galium boreale.
‡G. erectum.
†Picris echioides.
Hieracium iricum.
H. cæsium.
H. strictum.
H. umbellatum.
Arctostaphylos Uva-ursi.
Pyrola secunda.
Lithospermum officinale.
*Veronica peregrina.
Melampyrum sylvaticum
Orobanche rubra.
Utricularia intermedia.
†Mentha Pulegium.
Stachys Betonica
*Plantago media.
Polygonum mite.
Ulmus montana.
‡Salix fragilis.
S. phylicifolia.
Taxus baccata.
Malaxis paludosa.
Spiranthes Romanzoffiana.
Potamogeton prælongus.
Eriophorum latifolium.
Carex pauciflora.
C. muricata.
C. elongata.
C. Buxbaumii.
C. aquatilis.
C. irrigua.
C. Pseudo-cyperus.
Calamagrostis stricta (*var.* Hookeri).
Hymenophyllum tunbridgense.
Lastrea Thelypteris.
Polypodium Dryopteris.
Equisetum pratense.
Pilularia globulifera.

To compare the Down and Antrim flora with that of the adjacent counties. Adjoining Antrim on the west is Londonderry. Down, Antrim, and Londonderry together compose District XII of *Cybele Hibernica*. The eastern half of Derry is formed of a continuation of the Antrim basaltic plateau, and yields a closely similar vegetation, the Benevenagh cliffs possessing a remarkable alpine flora, of which several members are unknown in Antrim. The western half consists largely of metamorphic rocks, rising in the Sperrin mountains to 2,240 feet, and yielding a couple of alpine plants unknown in our district. The number of Derry plants which do not occur in Down or Antrim is but 12, as follows :

Draba incana
Silene acaulis
Saxifraga oppositifolia
} Benevenagh.

Rubus Chamæmorus } Sperrin Mountains.
Carex rigida }
Cochlearia anglica.
†Galium Mollugo.
Hieracium prenanthoides.
Hypochæris glabra.
Calamagrostis Epigejos.
Lastrea spinulosa.
Equisetum variegatum.

Armagh adjoins Down on the westward, and is an area of very similar character, except that a stretch of Carboniferous limestone brings in some calcicole species, and its almost inland situation cuts out the majority of sea-coast plants. The number of Armagh plants not found in Down or Antrim is 10, most of them being species which are of more or less frequent occurrence further south or west :

*Clematis vitalba.
Ranunculus Baudotii (*var.* confusus).
Fumaria densiflora.
*Diplotaxis muralis.
†Galium Mollugo.
*Matricaria discoidea.
Arctium majus.
Potamogeton filiformis.
Bromus commutatus.
Nitella flexilis.

The distribution of the flora in Down and Antrim calls for a few remarks. The greater part of Down consists of low (under 500 feet), undulating country, formed of Silurian slates, and the leading feature of its flora is that it is distinctly calcifuge. Of 10 species classed in *Cybele Hibernica* as "*calcicole A*," only two—*Carlina vulgaris* and *Orchis pyramidalis*—have been found in the county; chiefly on sea-sands, where lime may be abundant. Of 31 more classed as "*calcicole B*," 14 occur ; namely :

Aquilegia vulgaris.
Reseda Luteola.
Anthyllis Vulneraria.
Pimpinella Saxifraga.
Tussilago Farfara.
Leontodon hirtus.
‡Verbascum Thapsus.
*Verbena officinalis.
‡Origanum vulgare.
Juncus glaucus.
Carex glauca.
Trisetum flavescens.
Avena pubescens.
Ceterach officinarum.

On the other hand, calcifuge species are numerous and often abundant, such as the following:

Cytisus scoparius.	Polygonum Hydropiper.
Ulex Gallii.	Rumex Acetosella.
Lathyrus macrorrhizus.	Juncus squarrosus.
Galium saxatile.	Carex binervis.
Vaccinium Myrtillus.	Blechnum Spicant.
Digitalis purpurea.	Athyrium Filix-fæmina.

R. Welch. *Photo.*

MOURNE MOUNTAINS,
SHOWING GRANITE CLIFFS AND HEATHERY SLOPES.

The Mourne mountains are poor in alpine plants, despite the fact that over a dozen peaks exceed 2,000 feet in elevation; the dry massive granites are inhospitable, the slates little better. The plants which are in our district confined to the Mournes are few in number:

Drosera intermedia.	Hieracium argenteum.
Saussurea alpina.	H. hibernicum.
Hieracium senescens.	H. gothicum *var.* Stewartii.

Among the rarest Irish plants occurring in or about the Mournes are :

Meconopsis cambrica.	Hieracium crocatum.
Epilobium angustifolium.	Pyrola minor.
Hieracium lasiophyllum.	Linaria repens.
H. flocculosum.	Cryptogramme crispa.
H. auratum.	

The coast-line of Down is generally low and rocky, with sandy bays ; in Antrim bolder, often cliff-bound, with stony and sandy reaches. On the shores of both counties grow

Thalictrum dunense.	Atriplex farinosa.
Vicia lathyroides.	Euphorbia portlandica.
Ligusticum scoticum.	Scilla verna.
Mertensia maritima.	Ruppia spiralis.
Convolvulus Soldanella.	Scirpus rufus.
Atriplex littoralis.	

In Down only we find

Glaucium flavum.	Atriplex portulacoides.
Artemisia maritima.	Zannichellia polycarpa.
Statice occidentalis.	Eleocharis uniglumis.
Cynoglossum officinale.	

The first five of these reach here their northern limit in eastern Ireland; the sixth has no other station in the country; while the last appears again further northward in Londonderry. Against these, Antrim has no seaside plants absent from Down.

As regards lake-plants, Lough Neagh, which lies on the western edge of our district, possesses much interest. Two plants of the lake-shore—*Carex Buxbaumii* and *Calamagrostis stricta* var. *Hookeri*—are unknown elsewhere in Ireland, being exceedingly rare in the British Isles, and characteristic of northern Europe. If the record for *Tolypella nidifica* be correct, Lough Neagh is the only station in the British Isles for this plant. The North American orchid *Spiranthes Romanzoffiana* occurs in four places in the Lough Neagh basin, in Antrim, Derry, and Armagh. This is the rarest plant in our flora, its only other European stations being in Co. Cork ; elsewhere it is confined to

sub-arctic North America and Kamtschatka. The shores of Lough Neagh also yield a group of plants which are usually maritime:

Scirpus maritimus.	Cerastium arvense.
S. Tabernæmontani.	Viola Curtisii.
Spergularia rupestris.	Erodium cicutarium.
Cerastium semidecandrum.	Trifolium arvense.

R. Welch. *Photo.*

SHORES OF LOUGH NEAGH AT SHANE'S CASTLE.

Habitat of *Calamagrostis stricta* var. *Hookeri.*

The sandy nature of the ground may account for the presence of the last five ; as for the others, when we take into account the northern character of the fauna and flora of the lake, and its low elevation (48 feet), one is tempted to refer their arrival to a period when a depression of the land allowed the sea to enter the basin about the close of the Glacial period. Lough Neagh was also the head-quarters in our district of an interesting group of marsh and water plants, many of them characteristic of the Central Plain of Ireland, but these have been much interfered with by the lowering of the level of the lake half a century ago.

In the following list, brackets refer to plants not recently seen, and which may be extinct on Lough Neagh owing to this cause; the letter E is prefixed to plants apparently extinct on that portion of the lake which belongs to Down or Antrim:

Ranunculus circinatus.	E. Lathyrus palustris.
(Subularia aquatica.)	(Sium latifolium.)
(Elatine Hydropiper.)	(Carex elongata.)
Rhamnus Frangula.	(C. filiformis.)
(R. catharticus.)	E. Pilularia globulifera.

The Antrim mountains present great stretches of bog of from 1,000 to 1,500 feet elevation. This ground yields *Carex pauciflora* and *C. irrigua*, both unknown elsewhere in Ireland; also *Saxifraga Hirculus*. On less elevated bogs, *Utricularia intermedia*, *Malaxis paludosa*, and *Eriophorum latifolium* have their only stations in the district. On the eastern side the plateau presents a precipitous escarpment towards the sea, carved into deep glens. On these cliffs of basalt grow many of the plants characteristic of the Antrim flora:

Arenaria verna.	Saxifraga hypnoides.
Vicia Orobus.	Hieracium iricum.
Dryas octopetala.	Orobanche rubra.

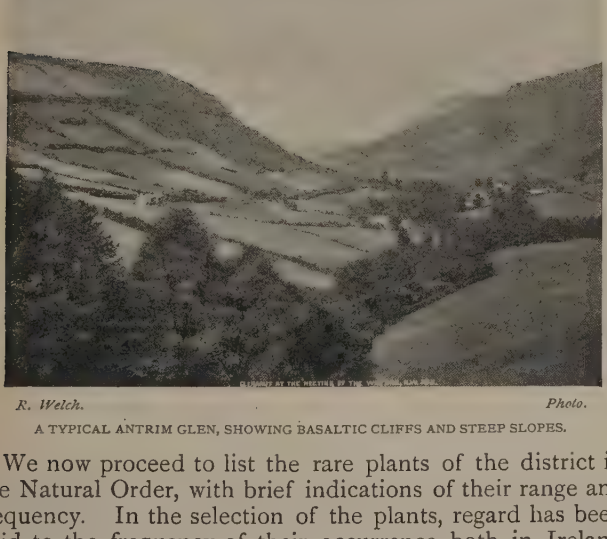
Others haunt the slopes and deep glens:

Geranium sylvaticum.	Melampyrum sylvaticum.
G. pratense.	Equisetum pratense.
Pyrola secunda.	

The basalts supply to a certain extent the requirements of the calcicole plants, without excluding the species of calcifuge proclivities, and the flora of Antrim is therefore not so distinctly calcifuge as that of Down. Still, of the ten "*calcicole A*" plants of *Cybele Hibernica*, only three occur:—*Geranium lucidum* is widely spread; *Orchis pyramidalis* grows on chalk rubbish near Lisburn (the only limestone plant, apparently, brought in by the girdle of Chalk which fringes the basalt escarpment); *Carlina vulgaris* occurs sparingly on sea-sands, as in Down. Of "*calcicole B*" plants, all the species already listed for Down occur, except the introduced

Verbena; and in addition, *Poterium Sanguisorba* and *Galium boreale* are found. A number of other Antrim plants absent from Down are usually—at least in Ireland—found in limestone districts:

Cerastium arvense.	Parnassia palustris.
Arenaria verna.	Myriophyllum verticillatum.
Hypericum hirsutum.	Carex muricata.
Vicia Orobus.	Lastrea Thelypteris.



R. Welch. *Photo.*

A TYPICAL ANTRIM GLEN, SHOWING BASALTIC CLIFFS AND STEEP SLOPES.

We now proceed to list the rare plants of the district in the Natural Order, with brief indications of their range and frequency. In the selection of the plants, regard has been paid to the frequency of their occurrence both in Ireland and in Great Britain.

Rare Plants of Down and Antrim.

Thalictrum dunense *Dum.*—D., Dundrum and Benderg Bays; A., Ballycastle, Portrush.

Ranunculus circinatus *Sibth.*—D., Canal at Lough Neagh; northern limit in Ireland; a Central Plain plant.

R. fluitans *Lamk.*—A., Six-mile River; only Irish station.

†**Papaver hybridum** *L.*—D., Killough and westward; Groomsport, Holywood.

Meconopsis cambrica *Vig.*—D., Rostrevor; A., Fair Head, Garron Point.

Glaucium flavum *Crantz.*—D., South half of coast; northern limit in Ireland.

Fumaria pallidiflora *Jord.*—Common in both counties.

F. muralis *Sonder.*—D., Saintfield; A., Rathlin, Belfast.

Barbarea intermedia *Boreau.*—D. and A., very frequent. In Ireland, almost confined to the north-east.

Cardamine amara *L.*—North Down and South Antrim. In Ireland, confined to Ulster.

†**Lepidium campestre** *R. Br.*—D., Killowen; A., about Lough Neagh.

Teesdalia nudicaulis *R. Br.*—D., abundant at Ballykinler; also sparingly near Lisburn, whither it is believed to have spread from its station by Lough Neagh in Co. Tyrone.

Crambe maritima *L.*—D., Knockinelder; A., Rathlin, now extinct.

Raphanus maritimus *Sm.*—In both counties, but rare.

Viola Curtisii *Forst.*—D. and A.; common on coasts, rare inland.

Polygala oxyptera *Reichb.*—In both counties; rare.

‡**Silene noctiflora** *L.*—D. and A., rare and uncertain.

Cerastium arvense *L.*—A., by Lough Neagh at Antrim.

Stellaria palustris *Retz.*—D., Lough Keelan near Ardglass.

Arenaria verna *L.*—A., frequent; also in Derry and Clare only.

Sagina subulata *Presl.*—Antrim coast, locally.

Spergularia rubra *Presl.*—D., Lough Island Reavy, Lenaderg; A., Dunluce, Lough Beg. Very rare in Ireland.

S. rupestris *Lebel.*—D. and A., common on coast.

Elatine hexandra *DC.*—D., several lakes in the centre

E. Hydropiper *L.*—D., Lough Briclan and canal at

Lisburn ; also about the entrance of the Lagan Canal into Lough Neagh, but not seen recently there. In its only other Irish station (canal near Newry, Co. Armagh, 1836) it has not been refound. Extremely rare in Britain.

Hypericum hirsutum *L.*—A., Macedon Point. Elsewhere in Ireland confined to a restricted area on the limestone in Dublin, Kildare, and Meath.

Lavatera arborea *L.*—A., North coast, frequent and native.

Geranium sylvaticum *L.*—A., Glenarm neighbourhood ; the only Irish station.

G. pratense *L.*—A., North coast, locally plentiful. Absent from the rest of Ireland

Erodium moschatum *L'Hérit.*—In both counties ; very rare.

E. maritimum *L'Hérit.*—D., frequent ; A., very rare, and not seen recently.

Trifolium striatum *L.*—D., Common in Ardglass district ; A., Whitehead.

T. filiforme *L.*—D., Ardglass.

Trigonella ornithopodioides *DC.*—D., three stations near Ardglass.

Vicia Orobus *L.*—A., Sallagh Braes. The only other Irish stations are on the limestone in Galway and King's County.

V. lathyroides *L.*—D. and A. ; coast, rare and local.

Lathyrus palustris *L.*—A., apparently extinct in three Lough Neagh stations owing to drainage.

Rubus.—The *Rubi* of the north-east of Ireland are better known than those of any other portion of the country. Out of the 101 "species" described in Rogers's "Handbook," 46 occur in Down and Antrim. In addition to these, two new forms—*R. Lettii* and *R. dunensis*—have been recently described by Mr. Rogers from Down and Armagh. Of the 48 Brambles which thus form the local *Rubus* flora, 4 are unknown elsewhere in Ireland: *Rubus nemoralis*, *R. criniger*, *R. Borœanus*, *R. regillus* ; while the following are rare in the British Isles : *Rubus Rogersii*, *R. nitidus*, *R. nemoralis*, *R. villicaulis*, *R. argentatus*, *R. Myricæ*, *R. Salteri*, *R. micans*, *R. hirtifolius*, *R. criniger*, *R. Borœanus*,

R. cinerosus, *R. Gelertii*, *R. anglosaxonicus*, *R. Borreri*, *R. Drejeri*, *R. rudis*, *R. oigocladus*, *R. regillus*, *R. mutabilis*, *R. Babingtonii*, *R. Bloxamii*, *R. fuscus*, *R. scaber*, *R. hirtus*, *R. saxicolus*.

Dryas octopetala *L.*—A., cliffs north of Knockdhu.

Agrimonia odorata *Mill.*—D. and A., rare.

Poterium officinale *Hook. fil.*—D., Donaghadee; A., Carnlough and Rasharkin.

Rosa involuta *Smith.*—Rare in Down, frequent in Antrim.

R. hibernica *Smith.*—D., Holywood, and formerly at Stranmillis; A., Glenarm; in Derry also alone. Very rare in Great Britain.

R. glauca *Vill.*—D., Saintfield; A., Belfast and Larne. Also in Armagh and Derry only.

Saxifraga Hirculus *L.*—A., Garron Point and Rasharkin.

S. aizoides *L.*—A., north-east corner, locally abundant, descending to sea-level; elsewhere in Ireland confined to the north-west.

†**S. granulata** *L.*—D. and A., rare, and possibly not native.

S. hypnoides *L.*—A., frequent round the coast, in the forms *gemmifera* and *sponhemica*.

Sedum Rhodiola *DC.*—D., Mourne mountains; A., frequent in the north-east.

Drosera anglica *Huds.* — D., Cotton Moss; A., frequent.

D. intermedia *Hayne.*—D., along the Kilkeel river.

Callitriche autumnalis *L.*—D. and A., rather rare.

Epilobium angustifolium *L.*—D., Mourne mountains, rare; A., frequent; very rare in Ireland.

†**E. roseum** *L.*—D. and A., about Lisburn; also in Dublin, Louth, and Armagh only; possibly not native.

Circæa alpina *L.*—Rare in Down; frequent in Antrim. In Ireland confined to the northern third.

Cicuta virosa *L.*—D. and A., rare and local. Northern half of Ireland, avoiding the west coast.

Carum verticillatum *L.*—A., Ballycastle to Giant's Causeway, rare. North and south-west of Ireland, very local.

***Myrrhis odorata** *Scop.* — D. and A., frequent. Northern half of Ireland.

Crithmum maritimum *L.*—D., widespread, but rare.

Ligusticum scoticum *L.* — Coast of Antrim and North Down, rare; also in Derry and Donegal only.

Adoxa Moschatellina *L.*—A., near Belfast; almost extinct. A common plant in Great Britain, but with no other Irish station.

†Galium Cruciata *Scop.*—D., Downpatrick; also in Fermanagh only. Almost throughout Great Britain; possibly introduced in Ireland.

‡G. erectum *Huds.*—D. and A., rare, and probably introduced.

Valeriana Mikanii *Syme.*—Rare in Down; frequent in Antrim.

***Valerianella carinata** *Loisel.*—D., established at Dundonald for thirty years.

Artemisia maritima *L.*—D., Killough.

Arctium nemorosum *Lej.*—D. and A., apparently frequent.

Saussurea alpina *DC.*—D., Mourne mountains, one station.

†Picris echioides *L.*—A., Blackhead and Island Magee.

***Crepis biennis** *L.* — D. and A., rare, but locally abundant.

Hieracium senescens *Backh.*—D., Tollymore Park. The only station for the only Hawkweed of the *alpina* section yet found in Ireland.

H. flocculosum *Backh.*—D., Spinkwee river; A., Sallagh Braes. The only Irish stations.

H. Farrense *F. J. Hanb.*—A., Sallagh Braes, the only Irish station.

H. argenteum *Fr.*—D., Mourne mountains in several places.

H. hibernicum *F. J. Hanb.*—D., near Rostrevor; also one station in Galway and one in Scotland; unknown elsewhere.

H. euprepes *F. J. Hanb.*—A., not rare. In Ireland, in Derry also alone.

H. auratum *Fr.*—Frequent in Mourne mountains and in Antrim. Elsewhere in Ireland in Donegal only.

Lobelia Dortmanna *L.*—D. and A, rare; occurs at all levels.

Arctostaphylos Uva-ursi *Spreng.*—A., Fair Head; not seen since 1837.

Andromeda Polifolia *L.*—D., Wolf Island bog; becoming extinct owing to turf-cutting.

Pyrola media *Sw.*—D., Conlig Hill; A., a number of stations.

P. minor *L.*—D., Tollymore Park; A., a number of stations.

P. secunda *L.*—A., Glenarm, Sallagh Braes, Agnew's Hill; not seen since first discovered about 1835. An old station in Derry and a recent one in Fermanagh complete its Irish distribution.

Statice rariflora *Drej.*—D., frequent; A., Larne Lough.

S. occidentalis, *Lloyd.*—D., near Ballyhornan.

‡**Hottonia palustris** *L.*—D., Crossgar and Downpatrick; known here for a century, but probably originally introduced. Planted in some other stations in both counties.

Centunculus minimus *L.*—D., frequent; A., Bushfoot, Rathlin.

Cynoglossum officinale *L.*—D., Frequent on the coast to Portavo, its northern limit in Ireland.

Mertensia maritima *S. F. Gray.*—D., south, very rare; A., Garron Head and Island Magee, not seen recently.

Calystegia Soldanella *R. Br.*—D. and A., very rare.

Linaria repens *Mill.*—D., abundant about Killowen; also in Armagh, Donegal, and Cork only.

Melampyrum sylvaticum *L.*—A., in many of the glens. In Ireland confined to these and one station in Derry.

Orobanche rubra *Smith.*—A., frequent; characteristic of the basaltic plateau of N.E. Ireland.

Utricularia intermedia *Hayne.*—A., near Rasharkin.

Pinguicula lusitanica *L.*—Frequent in both counties.

†**Mentha Pulegium** *L.*—A., by Lough Beg.

Stachys Betonica *Benth.*—A., Broughshane, Shane's Castle.

Lamium intermedium *Fr.* — Common in both counties.

Atriplex littoralis *L.*—Down and Antrim; local.

A. farinosa *Dum.*—Frequent in Down; rare in Antrim. In Ireland confined to the east coast.

A. portulacoides *L.*—D., Newry river to Guns Island. Northern limit in Ireland.

Polygonum Raii *Bab.*—Frequent in Down; rare in Antrim.

P. mite *Schrank.*—A., Shane's Castle.

P. maculatum *Trimen and Dyer.*—D., Dundrum.

Euphorbia Paralias *L.*—D., frequent; A., Bushfoot.

E. portlandica *L.*—South Down and North Antrim.

Mercurialis perennis *L.*—Very rare in both counties. A scarce plant throughout Ireland.

Ulmus montana *L.*—A., native in mountain glens. Very rare in Ireland as an indigenous species.

Salix triandra *L.*—D., Ballyalloly; A., south, rare.

S. phylicifolia *L.*—A., Glenballyemon; not seen recently.

S. nigricans *Sm.*—A., rare, and not seen recently.

S. herbacea *L.*—D., Mournes, common; A, Slievenanee.

Ceratophyllum demersum *L.*—D., rare; A., Rathlin Island.

Juniperus nana *Willd.*—D. and A., mountains; local.

Taxus baccata *L.*—A., cliffs; now almost extinct.

Hydrocharis Morsus-ranæ *L.*—D., Portaferry; A., about Portmore.

Malaxis paludosa *Sw.*—A., northern half; rare.

Spiranthes Romanzoffiana *Cham.*—A., between Toome and Antrim. The rarest plant in our flora, being in Europe confined to four Irish counties: Antrim, Derry, Armagh, and Cork.

Cephalanthera ensifolia *Rich.*—D. and A., now probably extinct.

Epipactis media *Fr.*—A., Glenarm.

Habenaria albida *R. Br.*—Antrim and North Down, rare.

Allium vineale *L.*—D., Rockport; A., Antrim and Shane's Castle.

Scilla verna *L.*—D. and A., frequent. In Ireland confined to the east coast from Wicklow to Derry.

Typha angustifolia *L.*—In both counties, sparingly

Sparganium affine *Schnizl.*—In both counties, rare.

***Acorus Calamus** *L.*—D. and A., abundant throughout the Lagan Canal; originally introduced, as in its few other Irish stations.

Butomus umbellatus *L.*—In both counties, rare and local.

R. Welch. *Photo.*

GROUP OF SPIRANTHES ROMANZOFFIANA.
Collected in Co. Armagh.

Potamogeton plantagineus *Ducr.*—D., Ardglass district.

P. nitens *Weber.*—D., Lough Aghery and Annsboro' Lake; A., Dunadry.

P. Zizii *Roth.*—D., Lagan Canal; A., chiefly in Bann basin.

P. prælongus *Wulf.*—A., widespread, but rare.

P. flabellatus *Bab.*—D., Killough.

Ruppia spiralis *Hartm.*— Frequent in Down and South Antrim; much commoner than *R. rostellata.*

Zannichellia polycarpa *Nolte.*—D., Salt marshes at Belfast. Unknown elsewhere in Ireland, and has only two stations in Great Britain.

Eleocharis uniglumis *Link.*—D., Groomsport, Killough, Bangor.

Scirpus Savii *S. and M.*— In both counties, not common.

S. rufus *Schrad.*—Frequent in Down; rare in Antrim.

Eriophorum latifolium *Hoppe.*—A., near Rasharkin.

Cladium Mariscus *R. Br.*— Castlewellan, Killough, Strangford; A., Lough Neagh, extinct (?).

Carex pauciflora *Lightf.*—A., Carnlough and Parkmore. Only stations in Ireland.

C. muricata *L.*—A., Giant's Causeway and near Belfast.

C. elongata *L.*—Found at Selshan, on Lough Neagh, in 1838; now extinct. Only one other Irish station, in Fermanagh.

C. Buxbaumii *Wahl.*—A., Harbour Island in Lough Neagh; nearly extinct through drainage. The only other station in the British Isles is in West Inverness.

C. aquatilis *Wahl.*—A., Ballymena and Shane's Castle.

C. limosa *L.*—In both counties; very rare.

C. strigosa *Huds.*—D., Belvoir Park, Crawfordsburn; A., frequent.

C. filiformis *L.*—D., abundant in Ardglass district; A., formerly at Lough Neagh.

C. Pseudo-cyperus *L.*—A., Bog Meadows.

Calamagrostis stricta *Nutt.*, var. **Hookeri** *Syme.*—A., north margin of Lough Neagh; rare. The variety is endemic at Lough Neagh, growing in various spots round the margin. The type is unknown in Ireland, and very rare in Great Britain.

Poa compressa *L.*— D., Hillsborough, Lenaderg; A., rare.

Festuca rottbœllioides *Kunth.*—In both counties; not common.

F. sylvatica *Vill.*—D., Newcastle, Rostrevor; A., very rare, and not seen recently.

Bromus racemosus *L.*—D., Holywood, Rathfriland; A., frequent.

Agropyron acutum *R. and S.* — D., Ballyhornan; A., Red Bay.

Hordeum secalinum *Schreb.* — D. and A., about Belfast; now nearly extinct.

Hymenophyllum tunbridgense *Smith.*—A., Glendun.

Cryptogramme crispa *R. Br.*—Mourne and Antrim mountains, very rare.

Lastrea Thelypteris *Presl.* — A., Portmore, Ballyclare; not seen recently.

L. æmula *Brack.*—Frequent in both counties.

Polypodium Dryopteris *L.*—A., Knocklayd; not seen since first discovered over sixty years ago; extremely rare in Ireland.

E. pratense *Ehrh.* — A., in a number of stations. Elsewhere in Ireland found in Donegal only.

Equisetum hyemale *L.*—D. and A., local and rare.

E. trachyodon *Braun.* — A., Colin Glen, Glenarm, Glenariff. In eight Irish and one Scotch county.

Lycopodium alpinum *L.*—Mourne and Antrim mountains.

Isoetes lacustris *L.*—D., south half, rare; A., widespread, rare.

Pilularia globulifera *L.*—Lough Neagh and Portmore. Not seen in our district since Lough Neagh was drained. Very rare in Ireland.

Chara aspera *Willd.*—In both counties, rare.

C. polyacantha *Braun.*—D., Tyrella.

C. contraria *Kuetz.*—D., Clandeboye Lake.

Nitella translucens *Ag.*—In both counties, rare.

Ferns are so favourite a group that some details as to the fern flora may be of interest, especially since special attention has been paid in the district to the extraordinary sports to

which these plants are subject. The following is a list of local species. Their occurrence in Down or Antrim is shown by the letters D. or A., and their frequency in Ireland by a number showing in how many of the 40 Irish botanical divisions each has been found :

Hymenophyllum tunbridgense ...	A. 23.	Cystopteris fragilis	D. A. 32.
H. unilaterale ...	D. A. 26.	Aspidium aculeatum	D. A. 37.
Pteris Aquilina ...	D. A. 40.	A. angulare... ...	D. A. 40.
Cryptogramme crispa	D. A. 6.	Lastrea Thelypteris	A. 14.
Blechnum Spicant	D. A. 39.	L. Oreopteris ...	D. A. 30.
Asplenium Adiantum-nigrum ...	D. A. 40.	L. Filix-mas ...	D. A. 40.
A. marinum ...	D. A. 20.	L. dilatata	D. A. 40.
A. Trichomanes ...	D. A. 40.	L. æmula	D. A. 37.
A. Ruta-muraria ...	D. A. 40.	Polypodium vulgare	D. A. 40.
Athyrium Filix-fæmina	D. A. 40.	P. Dryopteris ...	A. 5.
Ceterach officinarum	D. A. 40.	P. Phegopteris ...	D. A. 20.
Scolopendrium vulgare...	D. A. 40.	Osmunda regalis...	D. A. 38.
		Ophioglossum vulgatum	D. A. 35.
		Botrychium Lunaria	D. A. 35.

The Irish ferns not in Down or Antrim are—

Trichomanes radicans...	13.	Asplenium viride ...	12.
Adiantum Capillus-Veneris	6.	Aspidium Lonchitis ...	6.
Asplenium lanceolatum	3.	Lastrea spinulosa ...	34.

The variations of our local ferns have formed the life-long study of W. H. Phillips. The species which varies most in our district is *Aspidium angulare.* Next come *Athyrium Filix-fœmina*, *Scolopendrium vulgare*, *Blechnum Spicant*, *Lastrea Filix-mas*, *Polypodium vulgare*, in the order named ; and marked varieties have been also yielded by *Hymenophyllum unilaterale*, *Pteris Aquilina*, *Ceterach officinarum*, *Asplenium Adiantum-nigrum* and *A. Trichomanes*, *Lastrea Oreopteris*, *Ophioglossum vulgatum.*

The most marked of the local finds are—

A. angulare.—*Capitatum*, D. A. ; *cristatum*, D. A. ; *cuneato-setosum*, A. ; *decompositum*, D. A. ; *grandiceps*, A. ;

grandidens, D. ; *interruptum*, D. A. ; *acutilobum*, D. ; *divisilobum*, D. ; *tripinnatum*, D. A. ; *truncatum*, D. A. ; *variegatum*, D.

Athyrium Filix-fæmina.—*Conioides*, D. A. ; *cristatum*, D. ; *crispum*, A. ; *decompositum*, D. ; *elegans*, A. ; *interruptum*, D. A. ; *multifidum*, D. ; *reflexum*, D.

Scolopendrium vulgare.—*Cristatum*, D. ; *marginatum*, D. ; *muricatum*, A. ; *peraferens*, A. , *ramosum*, D. A. ; *variegatum*, A.

Blechnum Spicant.—*Anomalum*, D. ; *heterophyllum*, A. ; *cristatum*, D. ; *foliosum*, D. ; *serratum*, D. ; *trinervium*, D.

Lastrea Filix-mas.—*Cristata*, D. ; *confluens*, A. ; *polydactyla*, A.

Among other forms, the best is the well-known southern variety *acutum* of *Asplenium Adiantum-nigrum*, which grows near Newtownards, Co. Down.

References.—Moore and More, *Cybele Hibernica*, 2nd ed., 1898 ; Praeger, *Irish Topographical Botany*, 1901 ; Stewart and Corry, *Flora of the North-east of Ireland*, 1888 ; Stewart and Praeger, *Supplement to ditto*, 1895 (B.N.F.C. *Proc.*, 1894–5) ; ditto, *Report on the Botany of the Mourne Mountains*, 1892 (R.I.A. *Proc.* (3), ii, No. 2) ; Phillips and Praeger, *The Ferns of Ulster* (B.N.F.C. *Proc.*, 1885–6).

R. Ll. P.

MOSSES AND HEPATICS.

The Moss Flora of the counties of Antrim and Down has attracted attention for many years, and with the exception of a few of the more difficult groups, such as the "bog mosses," the *Harpidium* group of *Hypnum*, and some families of Hepatics, has been well worked out. As might be expected, from the varied character of the surface, the proximity of the mountains to the sea, and the presence of inland loughs, it is varied and interesting, and compares favourably with that of neighbouring counties.

The mountains and cliffs near the sea, wooded glens, sandhills and flats by the coast, inland basaltic cliffs, peat bogs, lake shores and marshes, all afford congenial homes for these lowly plants. The physical features, together with the humidity of climate and large rainfall, make it a good

district for Mosses. Most families of Mosses and Hepatics are well represented, with the exception perhaps of the "wood mosses," *Orthotrichaceæ*, which may be accounted for perhaps by the absence of large tracts of woodland.

The district does not produce any group of special interest like the south-west of Ireland, although we have a few species, such as *Lejeunea microscopica*, *Radula aquilegia*, and *Jubula Hutchinsiæ*, which have their headquarters there. Nor do we possess any peculiarly northern or American forms. A few southern species reach their northern limit here. *Ditrichum vaginans* (Sull.) Hampe, a continental species, which was lately found on Colin Mountain, County Antrim, is the only British species peculiar to the district.

From 1795 to 1825 the cryptogamic flora of the counties near Belfast was studied with great diligence and success by John Templeton of Cranmore, Belfast. He was familiar with the Mosses and Hepatics, Lichens, Fungi, and Algæ, freshwater and marine, of the north of Ireland, and had devoted particular attention to the Mosses and Hepatics, of which there are records from localities in Antrim and Down and drawings in the MS. of his unfinished *Hibernian Flora*. The coloured drawings of *Hepaticæ* are particularly good and lifelike. To the great loss of Irish Botany this work was never published. Robert Brown, Dr. Stokes, and Dr. Scott also collected in the north of Ireland, and at a later period Thomas Drummond. Dr. David Moore collected extensively in Co. Antrim, and added largely to our known flora in his lists of Irish Mosses and Hepatics, published in 1872 and 1876. The most complete account of the bryology of the two counties was published in 1888 in Stewart and Corry's *Flora of the North-East of Ireland*, where a full list with localities is given of 301 Mosses and 84 Hepatics.

In 1890 there appeared in the *Proceedings* of the Royal Irish Academy a List of the Mosses and Hepatics of the Mourne mountains, by the Rev. H. W. Lett, and in 1895 was issued a *Supplement to the Flora of the North-East*. These made many additions to the original lists, and with the later researches of a number of local bryologists, published in the *Irish Naturalist*, the number now stands at 384 Mosses and 102 Hepatics.

In Dixon's *Handbook of British Mosses* and the Moss Exchange Club *Catalogue of Hepaticæ*, the latest summaries of the British species, the Mosses number 600 species, *Hepaticæ* 220. Our district therefore contains considerably more than half the British Moss-flora and almost half the British *Hepaticæ*. Compared with the number of species for Ireland in Moore's lists (369 Mosses and 137 Hepatics—numbers however which have been augmented since 1872), the proportion is large.

Little has been done as yet to arrange these plants into groups according to their geographical distribution. It probably depends in their case to a greater degree on suitable habitats, shelter from sun and wind, and especially moisture, than on latitude or longitude, as in the case of the flowering plants.

While we have no special Lusitanian group of species, the following rare Western species form a link in this district between those of Kerry on the one hand, and the western coasts of Great Britain on the other, where they occur—Wales, the English Lake District, and the north-west coast of Scotland (where many species have lately been found which were supposed to be peculiar to south-west Ireland): *Ulota calvescens*, *Hpynum eugyrium*, *Jubula Hutchinsiæ*, *Lejeunea microscopica* and *L. ovata*, *Radula aquilegia*, *Adelanthus decipiens*, and *Plagiochila interrupta* var. *pyrenaica*.

Two interesting southern Mosses find their northern limit here—*Webera Tozeri* at Derriaghy, Co. Down, and *Hypnum illecebrum* at Sallagh Braes, Co. Antrim. There do not appear to be any American species. The following British genera and species are not represented: *Timmia*, *Œdipodium*, *Grimmia commutata*, *Barbula lurida*, *Leskea polyantha*, *Orthothecium*, *Hypnum nitens*, *H. cæspitosum*, *H. megapolitanum*, *H. circinatum*, *H. striatulum*, and *H. umbratum*; while *Encalypta vulgaris* is very rare, having been only found at Cave Hill and Lurigethan (but not recently), and *Aulacomnium androgynum*, reported many years ago from Manyburn.

The alpine mosses are not numerous or remarkable. Several, such as *Andreæa* and *Bryum alpinum*, are found

at sea-level where the mountains adjoin the sea near Newcastle. The following are found in the Mourne mountains, and some on Slemish and Fair Head, Co. Antrim: *Andræa alpina*, *A. crassinervia* and var. *Huntii*, *Oligotrichum hercynicum* (also on Cave Hill), *Grimmia funalis*, *G. robusta*, *Rhacomitrium elliptic.um*, *R. ramulosum*, *Dicranum Scottii*, *D. fuscescens*, *Dieranodontium longirostre* var. *alpinum* (at Cushendall), *Webera acuminata*, *W. elongata*, *Plagiobryum Zierii* (at Sallagh Braes and Cushendall), *Tetraplodon mnioides*, *Splachnum ampullaceum*, *Hypnum flagellare*, *H. sarmentosum*. Of *Hepaticæ* may be mentioned *Scapania purpurea*, *Nardia compressa*, *Anthelia julacea*, *Acolea obtusa*, and *A. crenulata*, a list which is chiefly remarkable for the absence of northern and alpine species such as are found on the higher mountains of Scotland.

On the sea-coasts, *Grimmia maritima* and *Ulota phyllantha* grow on rocks close to tide mark, and *Tortula inclinata* in the chinks; while on the sandhills at Newcastle have been found *Tortula ruraliformis*, *Bryum roseum*, *Mnium cuspidatum*, *Brachythecium albicans*, and *Mörckia hibernica*.

Many species grow on the extensive peat bogs and marshes which are spread throughout the two counties, but with the cutting out of the bogs and drainage are not so numerous as they once were. *Hypnum lycopodioides*, recorded early last century from Rasharkin, and *Amblyodon dealbatus* from the same place, and also found by Templeton at Holywood and Blaris, seem to be extinct now.

There is a marked contrast between the Mosses which grow on the basaltic and calcareous rocks of Antrim and the Silurian and granitic rocks of Down. Some species are confined to the basalt and Chalk, such as *Hedwigia imberbis* and *Pterogonium gracile* (Ballygally Head), *Tortula princeps* (Glenarm), *Anomodon viticulosus*, *Hypnum murale*, *H. crassinervium*, and *Metzgeria pubescens*. Others, though characteristic of these rocks, are not confined to them exclusively —*Grimmia conferta* var. *pruinosa*, *Glyphomitrium Daviesii*, and *Hypnum Teesdalii*.

Seligeria Doniana grows on Greensand rocks in Colin Glen; *S. pusilla* and *S. calcarea* on damp Chalk rocks and stones on the Belfast mountains. Another minute moss,

Weisia tenuis, is confined to the sandstone, and grows at Scrabo, Derriaghy, and Drumbo.

The following are a few of the rare or noteworthy species, with localities:

RARER MOSSES.

Tetraphis Browniana *Grev.*—Glens at Ballycastle.

Polytrichum strictum *Banks.*—Slieve Martin and Slieve Donard.

Fissidens incurvus *Starke.*—White Mountain.

F. pusillus *Wils.*—Rare. Black Mountain and Colin Glen.

Pleuridium alternifolium *Rabenh.*—On sandy ground, Warrenpoint and Lisburn.

Ditrichum pusillum *(Timm.)*—Cranmore, near Belfast.

D. vaginans *(Sull) Hampe.*—Summit of Colin Mountain, Co. Antrim, the only British locality.

Dicranella secunda *Lindb.* and **D. crispa** *Schimp.*—Purdysburn.

D. Schreberi *Schimp.*—Clayey ground near Lisburn.

D. squarrosa *Schimp.*—Very fine and abundant in the Mourne mountains; Glenariff: it fruits frequently.

Campylopus setifolius *Wils.*—Slieve Donard.

C. brevipilus *B. and S.*—Mourne mountains, and in dry bare places on the top of Colin.

Dicranum fuscescens *Turn.*—Rare, on rocks on Slieve Bingian and Bencrom.

D. Scottii *Turn.*—In similar places to the last, Shanslieve and Slieve Commedagh.

Ephemerum serratum *Hampe.*—Not common, on sandhills at Newcastle and elsewhere.

Ephemerum serratum *var.* **angustifolium** *B. and S.*—Very rare, on banks near Lisburn.

Pottia asperula *Mitt.*—On banks by the sea at Millisle.

P. viridifolia *Mitt.* and **P. crinita** *Wils.*—On basalt by the shore at Black Head.

Tortula marginata *Spr.*—On sandstone at Derriaghy.

T. princeps *De Not.*—Glenarm deerpark.

T. mutica *Lindb.*—Not uncommon on trunks of trees below floodmark, by the Lagan, Magheralin. Always barren, sometimes bearing gemmæ on the leaves.

Trichostomum litorale *Mitt.*—By the shore and on mountains not far from the sea; Groomsport; Rathlin; Cave Hill.

T. tenuirostre *Lindb.*—Glens of Antrim; Pigeon Rock Mountain.

Encalypta ciliata *Hoffm.*—Rare, on basalt at Agnew's Hill and Sallagh Braes.

Diphyscium foliosum *Mohr.*—Frequent in crevices of rocks in the Mournes, where it fruits frequently; Donard Lodge Demesne, etc.

Grimmia Hartmani *Schimp.*—Fair Head; White Mountain.

G. robusta *Fergus.*—Spalga Mountain; Fair Head.

G. Donii *Sm.*—Sallagh Braes; sparingly on back wall of Tollymore Park.

Rhacomitrium ellipticum *B and S.*—Slemish; Slieve Donard.

Glyphomitrium Daviesii *Brid.*—On the basaltic columns of Fair Head (R. Brown); Rathlin; Knocklayd and Ballygally; also on slate rocks and granite on Slieve Donard.

Zygodon conoideus *H. and T.*—On pear-trees at Orange Grove, near Belfast; Tollymore Park.

Orthotrichum Sprucei *Mont.*—On trees near the water at Drumbridge.

O. rivulare *Turn.*—Not uncommon on rocks and trees by streams at Derriaghy and Saintfield.

Ulota calvescens *Schimp.*—Very rare; Glenshesk, above Ballycastle.

Webera Tozeri *Schimp.*—On sandstone by a streamlet near Derriaghy-Milltown, Co. Antrim.

Bryum concinnatum *Spruce.*—Very rare, only observed sparingly on the talus below Sallagh Braes.

B. Mildei *Jur.*—Has been found on Slemish and Slieve Donard.

B. rubens *Mitt.*—Longstone Lane near Lisburn.

B. murale *Wils.*—Rare, on limestone near Moira.

B. roseum *Schreb.*—Glenarm, Cave Hill, sandhills near Newcastle and Ballykinler.

Philonotis calcarea *Schimp.*—Not common; in old freestone quarry at Kilwarlin, and the upper end of Colin Glen.

Mnium stellare *Reich.*—Very rare, Colin Glen.

M. serratum *Schrad.*—Has only been found in Colin Glen. It has probably been overlooked elsewhere.

M. subglobosum *B. and S.*—In deep marshes, Cave Hill; Creevy Lough, near Saintfield; White Mountain.

M. affine *Bland.*—In similar places, not infrequent.

Anomodon viticulosus *H. and T.*—On limestone at Larne, etc.

Amblystegium fluviatile *B. and S.*—Very rare, on rocks in weir at Corbet Lake, Co. Down.

A. Juratzkanum *Schimp.*—Kilroot.

A. varium *Lindb.*—This and the last species are very rare, but have probably been overlooked.

A. irriguum *B. and S.*—Drumbo, and near Lisburn.

Hypnum chrysophyllum *Brid.*—Rare, on granite at Glassdrumman, near Annalong.

H. intermedium *Lindb.*—Frequent in bogs and marshes at Hyde Park, near Carnmoney, and on Rathlin.

H. aduncum *Hedw.* var. **Kneiftii** *Schimp.*—Not uncommon; Creevy, near Saintfield; Glendivis; Loughbrickland. The type does not occur; the difficult forms of this and neighbouring species which form the group *Harpidium* have not yet been worked out for the district.

H. vernicosum *Lindb.*—Very rare, only recorded from a bog by the Lagan above Lisburn, and on White Mountain.

H. eugyrium *Schimp.*—Damp rocks by the Lagan above Lisburn.

H. patientiæ *Lindb.*—Frequent on wet sandy places by roadsides and in wet meadows, Carnmoney; Saintfield; Rostrevor.

H. scorpioides *L.*—Slieve Croob; Mourne mountains; Rathlin.

H. sarmentosum *Wahl.*—Near Ballycastle, and in marshes on Slieve Donard, but always barren.

H. stramineum *Dicks.*—Not common, Glenveagh and

Deer's Meadow in the Mournes; among heather in bog at Creevy, near Saintfield; and Glenmakerron.

H. illecebrum *De Not.*—Very rare, on top of Black Mountain, and on rock at foot of north end of Sallagh Braes.

Eurhynchium Stokesii *(Turn.)*—Frequent in woods at Saintfield, and elsewhere.

E. speciosum *Schimp.*—Rare; Rathlin; Glenarm; Knockagh; and Drumbo Glen.

E. crassinervium *B. and S.*—Rare, and not found off the limestone; on blocks in Cave Hill deerpark, and Carnmoney; not found in Co. Down.

E. Teesdalii *Schimp.*—Colin Glen; Woodburn, Manyburn.

Hyocomiun flagellare *B. and S.*—Glenariff; Tollymore Park; very luxuriant but barren. This beautiful species is a great ornament to the clear mountain rivulets of the Mournes.

Rhynchostegium murale *Hedw.*—Frequent near Belfast. Not found in Co. Down.

Brachythecium salebrosum *Hoffm.*—Derriaghy; Narrow-water; and Moygannon Glen, near Rostrevor.

Pterogonium gracile *Swartz.*—Rare. Ballygally Head; Grogan's Glen.

Pterygynandrum filiforme *Hedw.*—Recorded many years ago from Tollymore Park, but not found recently.

Fontinalis squamosa *L.*—In the river at Rostrevor.

Cryphæa heteromalla *Mohr.*—Widespread but not abundant. On trees at Drumnabreeze; Magheralin; and Cave Hill.

Leucodon sciuroides *Schwaegr.*—Very rare. Lambeg, not found recently.

Hedwigia imberbis *Spruce.*—On basalt at Fair Head and Ballygally. Not found in Co. Down.

Rarer Bog Mosses—Sphagnaceæ.

The true Bog Mosses, or *Sphagnaceæ*, are numerous in our bogs, marshes, woods, and wet spots on the mountains, but have not been as yet thoroughly examined.

Sphagnum papillosum *Lindb.*—Black Mountain; Glendun; Cotton Moss.

S. Austini *Sull.*—Very rare. Evish Mountain near Parkmore.

S. molle var. **Mülleri** *Braith.*—Rocky Mountain near Hilltown.

S. rigidum var. **compactum** *Schimp.*—Mourne mountains.

S. laricinum *Spruce.*—Bog near Ballygowan.

S. intermedium *Hoffm.*—Parkmore; Deer's Meadow in the Mournes.

RARER HEPATICS.

Frullania fragilifolia *Tayl.*—Rare, on rocks at Rasharkin; Cove Mountain in the Mournes.

F. germana *Tayl.*—Rathlin.

Jubula Hutchinsiæ *(Hook.)*—Very rare, on wet rocks at waterworks above Rostrevor, by the Spinkwee and Shimna rivers in Tollymore Park, and on rocks by the sea at Bloody Bridge.

Lejeunea Mackaii *(Hook.)*—Rocks at Gobbins and Redhall; on old yews in Tollymore Park.

L. ovata *Tayl.*—Slieve Donard; near Belfast; Glenariff.

L. calcarea *Lib.*—Tollymore Park; Glenariff.

L. calyptrifolia *(Hook.)*—Slieve Donard, very rare.

L. ulicina *Tayl.*—Rare; on old thorn at Gillhall; Colin Glen.

Radula aquilegia *Tayl.*—Very rare, on shady rocks by waterfall at Blackstairs on Slieve Donard.

Porella Thuja *Dicks.*—Woodburn and Colin Glen.

P. rivularis *Nees.*—Not uncommon on trees and rocks, by the Lagan at Magheralin, and at Saintfield.

Pleurozia cochleariformis *(Weiss).*—This beautiful plant, which is not found in England, is confined to a few localities, where it grows in very wet places, on the Hen and Rocky mountains near Hilltown, near Rasharkin, and Evish Mountain, Co. Antrim.

Herberta adunca *(Dicks.)*—Has only been found at Fair Head.

Bazzania trilobata *(L.)*.—Thomas Mountain and Slemish, rare.

Kantia arguta *(Mart.)*—Frequent on banks of clay or sand.

Cephalozia curvifolia *(Dicks.)*—Slieve Bingian, Shanslieve, and Hen Mountain.

C. fluitans *(Nees).*—Giant's Causeway.

C. Lammersiana *(Hüben).*—Abundant on Slieve Croob.

C. stellulifera *Tayl.*—Tollymore Park.

C. Francisci *(Hook.)*—On Hightown Hill near the Cave Hill; Kinnahalla in the Mourne mountains.

Adelanthus decipiens *(Hook.)*—Rare. Wood at upper end of Glenariff; Sallagh Braes.

Scapania resupinata *(Dill.)*—Not uncommon.

S. convexa *(Scop.)*—Glenarn and Hen Mountain.

S. subalpina *(Nees).*—Carnlough.

S. curta *(Mart.)*—Sallagh Braes.

Diplophyllum ovatum *(Dicks.)*—Very rare; only observed in small quantity on a rock on Shan Slieve, Mournes.

Mylia anomala *(Hook.)*—Annahilt bog (now extinct) and summit of Divis.

Plagiochila interrupta var. **pyrenaica** *Spruce.*—On roadside near the quay, Rostrevor.

Jungermannia turbinata *Raddi.*—Colin Glen; Glendivis.

J. barbata *Schmid.*—Not common. Slievemartin.

J. Lyoni *Tayl.*—Frequent; Cave Hill; Moygannon Glen.

J. incisa *Schrad.*—Not rare in bogs; Aughaloghan bog, Co. Antrim; Lisbane, near Saintfield; Ballygowan.

J. alpestris *Schleich.*—Near Saintfield.

J. bicrenata *Schmid.*—On rocks at roadside between Banbridge and Scarva.

Eucalyx hyalina *Lyell* and **E. obovata** *(Nees).*—Mournes.

Nardia compressa *(Hook.)*—Rare, by streams, Mourne mountains.

Marsupella Funckii *(Web and Mohr.)*—Black Mountain.

Acolea crenulata *(Gotts.)* and **A. obtusa** *Lindb.*—Not uncommon, Slieve Donard.

Fossombronia cristata *Lindb.*—Shore of Lough Bricklan.

Blasia pusilla *(L.)*—Not uncommon.

Metzgeria pubescens *(Schrank.)*—Scarce, and confined to dry limestone rocks, near Belfast and Sallagh Braes.

Chomiocarpon quadratus *(Scop.)*—Rare; Cregagh Glen; Kerr's Glen; and Sallagh Braes.

Targionia hypophylla *(L.)*—On warm basalt rocks, Cave Hill and Glenarm deerpark, not found recently.

Mörckia hibernica *(Hook.)*—Found sparingly in wet place on sandhills at Newcastle.

Riccia glauca *L.*—Colin Glen and rocks at Bangor.

Ricciella fluitans *(L.)*—In still ditches at Loughbrickland, and by Lagan Canal at Kilmore, Co. Down.

REFERENCES.—MOORE: *Mosses of Ireland (Proc.* R. I. Acad., 1872); ditto, *Irish Hepaticæ (Proc.* R. I. A., 1876); STEWART and CORRY: *Flora of the North-east of Ireland*, 1888; LETT: *Mosses, Hepaticæ, and Lichens of the Mourne Mountains (Proc.* R. I. A., 1889); STEWART and PRAEGER: *Supplement to Flora of the North-east of Ireland (Proc.* Belfast Nat. Field Club, 1895); *Irish Naturalist:* Papers by Waddell and Davies, 1898–1902.

C. H. W.

FUNGI.

The fungal flora of Antrim and Down has not been thoroughly worked out, though from time to time some attention has been given to it. Templeton studied this group, though not to the same extent as others, and formed a list of 226 species. After his time it seems to have been neglected until 1886, when Rev. H. W. Lett published the result of several years' work at the group in his *Fungi of the North of Ireland.* This useful list, in which Templeton's is embodied, is the only guide to the mycology of the north-east of Ireland. It contains many Down and a few Antrim records, and brings the total number of species up to 581. Compared with the 5,000 British species, or the 1,000 recorded for Leinster, the number may seem small, but it would require a much longer time and more workers to make a complete survey of this huge group of plants, which offers a fine field for work. In the absence of proper data it is not possible to say much as to how it compares with other floras. It appears however to be fairly rich,

although the extent of woodland is not very great. The woods at Cave Hill, Shane's Castle, Saintfield, Rademon, Tollymore Park, and Narrow-water have furnished a large number of *Agaricinæ*, while the smaller micro-fungi are to be found everywhere.

No peculiar or very rare species have been recorded. The truffle *(Tuber æstivum)* has not been met with in Antrim or Down. *Fistulina hepatica* Fr., so common and well known on Oaks in England, is rare here, having been found only near Belfast and at Tollymore Park. A very few of the rarer or more notable species only may be mentioned here.

Agaricus Ceciliæ *B. and Br.*—Rare; Narrow-water.

A. clypeolarius *Bull.*—Near Belfast.

A. flavo-brunneus *Fr.*—Magheralin.

A. colossus *Fr.*—Under trees at rere of Warrenpoint Church. A rare and curious species, the largest and hardest of all the agarics.

A. gilvus *Pers.*—Rademon.

A. militaris *Lasch.*—Rademon.

A. corticatus *Fr.*—On decaying sleepers of railway at Newcastle.

A. pelianthinus *Fr.*—Near Belfast.

A. cruentus *Fr.*—In pine woods, rare, Shane's Castle.

A. ectypus *Fr.*—A rare gregarious species; Donard Demesne and Tollymore Park.

A. ameides *B. and Br.*—Tollymore Park.

Cortinarius scaurus *Fr.*—Near Belfast.

C. Bulliardi *Fr.*—Near Belfast.

Hygrophorus obrusseus *Fr.*—Rostrevor Wood.

Lactarius pergamenus *Sow.*—Narrow-water demesne.

Russula adusta *Fr.*—Rademon.

Lentinus tigrinus *Fr.*—On old stumps, very rare, Ram's Island in Lough Neagh.

Boletus pachypus *Fr.*—Rostrevor and Tollymore Park.

Polyporus fibula *Fr.*—A small plant; on inside of window-sash of Rectory, Broughshane, Co. Antrim.

Herneola auricula-judæ *Berk.* — Not common; Maghera and Donard Demesne.

Morchella esculenta *Pers.*—Not common; Glenarm Park.

Helvella crispa *Fr.*—By roadside, Magheralin.

Helotium æruginosum *Fr.*—Common in the barren but rare in the perfect state; Tollymore Park.

Æcidium calthæ *Grev.*—On *Caltha palustris* as early as March 1881, Bangor, Co. Down.

References.—Templeton, Catalogue of Fungi of North of Ireland, edited by Taylor (*Ann. and Mag. Nat. Hist.*, 1840); Lett, Fungi of the North of Ireland (*Proc.* Belfast N.F.C., 1884–5, appendix).

Lichens.

Next to Mosses and Seaweeds, the Lichens of the north of Ireland occupied more attention early last century than any other group of Cryptogams. Templeton formed a large collection, which is referred to by Dr. Taylor in *Flora Hibernica*, where the results of his researches in Ulster are given. Later on, two well-known students of Lichens—Admiral Jones and Dr. Maingay (the latter especially from the neighbourhood of Ardglass)—made large additions to our knowledge of the Lichens of the district. Dr. Moore also collected a considerable number in Co. Antrim, including some rare species. Nothing has been done in recent years to add to our knowledge or bring it up to date, with the exception of a small collection made by the Rev. H. W. Lett in the Mourne Mountains. No very rare species are recorded, and the mountain group does not appear to be rich in these plants, although not as yet sufficiently explored.

The only species peculiar to Antrim or Down is *Lecidea Mooreana* Carroll, found at Crow Glen, near Belfast, Co. Antrim. *Lecidea Templetoni* Tayl., another rare species of this genus, was first described from a locality near Belfast. Cushendall and Sallagh Braes are the only Irish localities for *Solorina saccata*. The Iceland Moss *Cetraria islandica* has been found on Slieve Donard, its only other Irish locality being Mangerton. It is strange that the "tree lungwort," *Sticta pulmonaria*, one of the largest and commonest British Lichens, though widely spread in Scotland, has not yet been recorded from Ulster. No list has been published of the Lichens of the north-east of Ireland, but localities are given

in Leighton's *Flora*, from which most of the notes on the following species have been extracted.

Ephebe pubescens (*Light.*)—Near Belfast.

Lichina pygmæa (*Light.*) and **L. confinis** *Ach.*—On maritime rocks, Ardglass, Co. Down.

Collema myriococcum *Ach.*—Near Belfast.

C. flaccidum *Ach.*—Aghalee Bridge on the Lagan Canal.

Leptogium Burgessii (*Light.*)—Deer-park at Antrim.

Cladonia bellidiflora *Schær.*—Near Belfast, and on Slieve Martin.

C. squarrosa *Hoffm.*—Black Mountain, near Belfast.

C. bacillaris *Nyl.* f. **pityropoda** *Nyl.*—Colin Glen.

Stereocaulon paschale *Ach.*—Slieve Commedagh.

S. condensatum, var. **cereolinum** *Ach.*—A rare variety; on rocks at Giant's Causeway.

Usnea ceratina *Ach.* f. **ferruginascens** *Crombie.*—Near Belfast; the only Irish locality.

U. barbata f. **florida** *Fries.*—Belfast.

U. hirta *Hoffm.*—Near Belfast.

Alectoria lanata (*L.*)—On alpine rocks near Belfast; Hen and Chimney Rock mountains.

Cetraria islandica *Ach.*—The "Iceland Moss" is said in Crombie's *British Lichens* to grow on Slieve Donard.

Ramalina evernioides *Nyl.*—On trees and palings, rare in fruit, near Belfast.

R. scopulorum (*Dicks.*)—On maritime rocks, rare; Ardglass, Annalong.

Platysma triste (*Web.*)—Slieve Donard.

Nephromium lævigatum *Ach.* var. **parile** (*Ach.*)—Near Glenarm.

Peltigera aphthosa (*L.*)—On shady alpine rocks at Sallagh Braes, and near Belfast.

P. horizontalis (*L.*)—Co Antrim and Tollymore Park.

P. venosa (*L.*)—On the earth, rare; Knockagh, Co. Antrim.

Solorina saccata (*L.*)—The thallus of this beautiful plant is bright green when moist, reddish brown when dried, in which the apothecia or fruit are depressed. It is found at Cushendall and Sallagh Braes.

S. spongiosa *Nyl. ex Carroll.*—Head of Glenariff, the only Irish locality for this northern species. The beautiful *S. crocea* of the Grampians is found in Ireland only on Brandon Mountain.

Stictina crocata (*L.*)—On trees, mosses, etc., very local; Fair Head, Cushendall, Glenarm, and Belfast.

S. intricata *Nyl.* var. **Thouarsii** *Nyl.*—Glenarm.

Ricasolia lætevirens (*Light.*)—Glenarm

Parmelia incurva (*Pers.*)—On rocks at Knocklayd.

Physcia chrysophthalmia (*L.*)—On trees at Newcastle, and Cave Hill.

P. lychnea *Nyl.*—On rocks, old pales, and trunks of trees, Co. Antrim.

Psoroma hypnorum (*Vahl.*)—On mosses and earth, near Belfast and Carnlough.

Pannaria triptophylla (*Ach.*)—On trees in County Antrim.

P. carnosa (*Dicks.*) var. **determinata** *Nyl.*—A very rare variety. Carnlough.

Lecanora glaucocarpa *Wahl.* var. **pruinosa** *Wahl.*—On a bleached bone of a sea-bird among sandhills at Newcastle.

L. lutescens (*DC.*)—Glenarm.

L. lacustris *With.*—Slieve Bingian.

L. poliophæa *Wahl.*—Barclay's Rock, Co. Down.

L. holophæa *Mont.*—In the fissures of maritime rocks at Island Magee and Ardglass.

L. helicopis *Wahl.* and **L. albariella** *Nyl.*—On chalk at Glenarm and Garron Point.

L. hæmatomma (*Ehrh.*)—Fair Head and Glenarm.

Pertusaria fallax (*Pers.*)—Glenarm and Belfast.

P. velata (*Turn.*)—Ballygally Head.

P. nolens (*Nyl.*)—A very rare species, which grows on maritime rocks at Glenarm. The only other locality is Lough Feagh, in Connemara.

Urceolaria bryophila *Nyl.*—On mosses and Cladonias in Deer Park at Belfast.

Lecidea glaucolepidea *Nyl.*—A species confined to Ireland. Crochan Mountain near Ballintoy. This immense genus, with its 397 species, is well represented in the district.

L. lavata *Fr.*—On water-washed mountain rocks on Slieve Bingian.

L. Mooreana *Carroll.*—Very rare, on trap rocks, especially such as have been exposed to the weather, Crow Glen, near Belfast, the only locality known for this species.

L. gelatinosa *Flk.*—On earth, Slemish.

L. saxatilis *Schær.*—A rare species, growing on subalpine rocks, Divis Mountain.

L. grossa *Pers.*—On trunks of Elm, Ash, and Oak in shady woods, Belfast. It has large black apothecia and large bilocular spores.

L. Templetoni *Tayl.*—On mosses near Belfast. First described by Taylor in *Flora Hibernica* from this locality; found also on turf near Bantry by Miss Hutchins.

L. lutea (*Dicks.*)—Belfast.

L. excentrica *Ach.*—On calcareous rocks on Island-Magee.

Opegrapha Turneri (*Leight.*)—Frequent on Sycamore, Poplar, etc., Colin Glen, Brett's Glen.

O. saxicola *Ach.* var. **Chevallieri** *Leight.*—White or pale yellow, with black apothecia, on rocks in Colin Glen.

Stigmatidium circumscriptum (*Tayl.*)—Rare, on shaded rocks, Co. Antrim.

Graphis sophistica *Nyl.*—Frequent on Oaks. It has many forms, several of which have been found at Montalto, Cultra, and Bangor.

Normandina pulchella *Borr.*—A rare species found by Dr. Maingay overrunning *Jungermannia dilatata* on mossy trunks of trees in Tollymore Park, Co. Down.

Chiodecton albidum (*Tayl.*)—On dry rocks in shady situations, very rare, Co. Antrim.

Endocarpon rufescens *Ach.*—Cave Hill.

Verrucaria mucosa *Wahl.*—On rocks by the sea at Woburn, Co. Down. A considerable number of species have been recorded of this large genus, which contains 157 species. The district is richer in saxicolous, and especially maritime species, than in corticolous ones.

V. microsporoides *Nyl.*—On wave-washed rocks, Glenarm and Garron Point; a rare species; only recorded elsewhere from Kilkee in Co. Clare, and Alderney.

V. maura *Wahl.*—On rocks exposed to the action of the tide, Ardglass.

V. plumbea *Ach.*—On calcareous rocks near Belfast.

V. litoralis *Tayl.* and **V. terebrata** (*Mudd*).—On rocks at Glenarm.

V. rhyponta *Ach.*—On the smooth bark of young trees of Poplar, Alder, etc. Also often occurring as minute maculæ on the thallus of *Graphis scripta.* Deer Park at Glenarm.

References.—Taylor, in *Flora Hibernica*, 1836; Leighton, *Lichen Flora of Great Britain and Ireland*, 1879; Lett, Mosses and Lichens of Mourne Mountains (*Proc.* R.I.A., 1889); Crombie, *British Lichens*, vol. i, 1894.

C. H. W.

ALGÆ.

Marine Algæ.

The extensive and chequered coast-line of Antrim and Down affords exceptionally good opportunities for studying this beautiful and interesting group of plants. Fifty years ago the brilliant researches of Templeton, Drummond, Thompson, Harvey, and McCalla attracted much attention, and by their work they laid a sure foundation for future workers; and recently, through the work of Mr. Holmes and Mr. Batters, much has been added to our knowledge of this group. The Olive-brown Seaweeds, including the kelp-weeds and the many varieties of wracks, have long attracted attention, because of the associated kelp industry, still carried on along various parts of the coast. It is not sufficiently well known by those engaged in this industry, that not only are Oar-weeds or Laminarians the most valuable weeds to burn in preparing the best kelp, but, also, that the wracks are useless, and if used they reduce the market value of the kelp so prepared very materially. The Red Seaweeds include the Corallines, which are used as manure in some districts, owing to the carbonate of lime and potash which they contain. Another point concerning the Green Seaweeds of economic interest is the rôle many of these seaweeds seem to play when associated with decaying organic matter in certain districts, especially near densely

populated seaside localities. The foreshore nuisance in Belfast Lough seems largely due to the decaying Sea-lettuce left exposed at low tide. How far the presence of these weeds is an indication of putrefying animal matter present is not settled, but there is some evidence which tends to show that an increase of such weeds is directly proportional to the amount of sewage matter present.

Olive-brown Seaweeds *(Pheophyceæ)*.—In this group, including the common Oarweeds and larger species of wracks, there occur many typical genera. Many of the smaller, less conspicuous forms are also well represented. Of the rarer of these less familiar types we note the following: *Phlæspora brachiata* (Harv.) Born., found at the The Gobbins attached to *Fucus serratus*. *Striaria attenuata* grows in Belfast Lough and Strangford Lough. The genus *Streblonema* grows on other Algæ; the host-plants are either green, red, or olive-brown seaweeds. It exists as fine tufts of delicate filaments, which pierce the tissues of the host, forming intra-cortical threads, and in this way infecting other parts of the host-plant. *Streblonema Areschougii* Crn. grows as a little rounded cushion, the size of a large pin's head, on the surface of the thongs of the Button-wrack, *Himanthalia lorea*, at Murlough Bay, Co. Antrim. Of the genus *Ectocarpus*, many beautiful species are known from these shores. *Ectocarpus Hinksiæ*, first discovered at Ballycastle in 1840, is found also at Murlough. *E. penicillatus* C. Ag. grows on *Alaria esculenta*, and *E. fasciculatus* f. *drapernaldioides* Crn. are found at Murlough. *Arthrocladia villosa*, a southern form, is recorded from Carrickfergus by McCalla, and from the County Down coast by Mrs. Gatty: more recently it has been dredged in these localities. *Petrospongium Berkeleyi* is found at Murlough and the Giant's Causeway on rocks exposed to the surf at low water.

Red Seaweeds.—Many beautiful forms of this group *(Rhodophyceæ)* are found on these coasts. *Goniotrichum elegans* Le Jol. was dredged by Mr. Thompson in Strangford Lough. *Porphyra lencosticta* and *P. linearis* are found at Larne and Murlough. *Wildmannia miniata*, Murlough Bay. *Diploderma amplissimum*, Cushendall. *Phyllophora Traillii*, Tor Head. Many species of *Nitophyllum* are repre-

sented—*N. uncinatum*, *N. Gmelini*, *N. laceratum* and its variety *uncinatum*, *N. reptans*, *N. punctatum*, *N. Bonnemaisoni*, and *N. Hilliæ*—these occur at Murlough Bay. *Polysiphonia divaricata*, a rare form washed up at Murlough. Here also, on rocks at low water, grows *Ceramium Derbesii*, a plant not previously known in the British flora. Many forms of Calcareous Algæ are recorded from Down and Antrim; the following, among others, are of interest: *Lithothamnion lævigatum*, *L. Lenormandi*, *L. colliculosum* f. *rosea*, *L. fœcundum*, a northern species; *L. fasciculatum* f. *eunana* (the above are found in Larne Harbour).

Green Seaweeds.—The Confervoids, their allies the *Chlorophyceæ*, and the remaining group of the Blue-Green Seaweeds (*Cyanophyceæ*) have not attracted the same attention as the other groups hitherto; consequently less is known of their distribution. The following are known to occur: *Monostroma fuscum*, Larne; *M. Blyttii*, Larne; *M. Lactuca*, Tor Head; *Urospora penicillatum*, Tor Head; *Bryopsis plumosa*, Tor Head; *Rivularia Biasolettiana*, Tor Head, on rocks near high-water mark, exposed to spray.

References.—W. H. Harvey, *Phycologia Britannica*, 1846–51; Holmes and Batters, *A Revised List of the British Marine Algæ*, and an *Appendix* (*Ann. Bot.*, vol. v, 1890); T. Johnson and Miss Hensman, A List of Irish Corallinaceæ (*Sci. Proc.* R.D.S., vol. ix, 1, No. 3); T. Johnson, H. Hanna, Miss Hensman, and Miss Knowles, Irish Phæophyceæ (*Proc.* R.I.A., 3rd ser., vol. 5, No. 3; H. Hanna, Some Algæ from the Antrim Coast (*Irish Nat.*, vol. viii, No. 7).

H. H.

Freshwater Algæ.

A century ago, when they were not so well known as now, Templeton compiled a list of 75 species. There are also references to work done in this group by Robert Brown, Drummond, and William Thompson, who found *Anabæna flos-aquæ* var. *circinalis* Rabh. colouring the waters of Ballydrain Lake. Harvey mentions few localities in *Flora Hibernica*, nor does he refer to the work of previous botanists. Many localities for Diatoms are recorded from the two counties in O'Meara's Report.

The following are a few of those recorded by Templeton: *Lemanea fluviatilis*, in rapid streams on the Mourne moun-

tains; *Conferva cryptarum*, in the first cave at the Cave Hill, growing among *Hypnum tenellum*; *C. punctalis*, Bonnick's Moss; *C. genuflexa*, Lagan Canal at Stranmillis; *C. ochracea*, Lambeg.

Hassall records *Coccochloris* (*Palmella*) *Mooreana* Harv. from Shane's Castle, and *Glœocapsa livida* from County Antrim. Of the Diatoms, *Meloseira arenaria* is found at Larne and Giant's Causeway; *Gomphonema geminatum*, County Antrim; *Epithemia zebra* Kütz, on the moist conglomerate sandstone near Cushendall.

William West has just completed a most important list of the species found by him in the north of Ireland, a selection from which is given here.

Lemanea torulosa (*Roth*) *Ag.*—Tollymore Park.

Œdogonium platygynum *Wittr.*—Near the lake at Toome, Co. Antrim.

Hormiscia moniliformis (*Kutz.*) *Rabenh.*—Slieve Commedagh, Co. Down.

Draparnaudia plumosa (*Vauch.*) *Ag.*—Shanslieve, Co. Down.

Stigeoclonium protensum (*Dillw.*) *Kutz.*—Lough Neagh.

S. tenue (*Ag.*) *Rabenh.*—Lough Neagh.

Spirogyra inflata (*Vauch.*) *Rabenh.*—Lough Neagh.

S. varians (*Hass.*) *Kutz.*—Lough Neagh.

Penium curtum *Breb.*—Slieve Commedagh, Co. Down.

P. Libellala (*Föcke*) *Nordst.*—Slieve Donard.

P. polymorphum *Perty.*—Lough Neagh.

P. margaritaceum *Breb.*—Slieve Donard.

P. Navicula *Breb.*—Slieve Donard.

P. interruptum *Breb.*—Slieve Donard.

P. Mooreanum *Archer.*—Slieve Donard.

P. cruciferum (*De Bary*) *Wittr.*—Slieve Donard.

P. digitus (*Ehrenb.*) *Breb.*—Slieve Donard.

Cosmarium angulosum *Breb.* var. **concinnum** (*Rabenh.*) *West and West f.*—Slieve Bearnagh.

C. annulatum (*Näg.*) *De. Bary* var. **elegans** *Nordst.*—Slieve Bearnagh.

C. anceps *Lund.*—Slieve Donard.

C. Bocckii *Wille.*—Slieve Bearnagh.

E. Blythii *Wille.*—Slieve Commedagh.
C. Brebissonii *Menegh.*—Slieve Donard.
C. latum *Breb.*—Slieve Commedagh.

REFERENCES.—HARVEY, in *Flora Hibernica;* O'MEARA, Irish Diatomaceæ (*Proc.* R. I. Acad., 1875); W. WEST and Prof. G. S. WEST, Freshwater Algæ of North of Ireland (*Trans.* R. I. Acad., 1902).

C. H. W.

ZOOLOGY.

BY ROBERT PATTERSON, G. H. CARPENTER, J. N. HALBERT, REV. W. F. JOHNSON, A. R. NICHOLS, H. LAMONT ORR, R. LLOYD PRAEGER, R. F. SHARFF, R. WELCH, AND JOSEPH WRIGHT.

VERTEBRATA.

MAMMALIA.

THE first point that would strike an English naturalist is the extreme poverty of the list of Irish Mammals. Of the 71 Mammals on the British list, the whole of Ireland can only claim about 43, including the probably introduced Squirrel and the Fallow Deer. We have only half of the bats, one shrew, and two mice; while the Mole, Polecat, Weasel, Dormouse, Common Hare, and *all* the voles are entirely absent. "The absence of so many British Mammals shows, without doubt, that the land-connections between Ireland and Great Britain must have broken down before the latter country became separated from the Continent. Ireland is, therefore, the older of the two islands."[1] Indeed it is this poverty of the Irish list that makes the study of Irish Mammals doubly interesting and instructive, and the solution of various questions of geographical distribution has been aided to no small extent by the intelligent investigation of the peculiarities of the Irish fauna.

Owing to the wild and broken nature of large portions of the island, and the somewhat indifferent game-preserving that generally prevails, several of the more interesting animals, usually termed "vermin" in Great Britain, are

[1] G. H. CARPENTER.—"Ireland": Handbook for Irish Pav., Glasgow Internat. Exhibition, 1901.

fairly common in Ireland, and their habits can be more easily studied. There are probably more Martens in a single Irish county that could be named than in the half of England.

Of the 43 Irish Mammals, Antrim and Down can claim 33, but this number includes the two deer which are kept in private parks.

Chiroptera.—There are only seven species of bats found in Ireland out of fifteen British, and five of these are known in our district. The Long-eared Bat *(Plecotus auritus)* is commonly distributed over both counties, and has been recorded from places too numerous to mention. For so far the Whiskered Bat *(Vespertilio mystacinus)* has not occurred in County Antrim, but in July 1898 W. Hartley Patterson sent me the first specimen known from County Down, taken at Dromore, and in March 1899 Canon Lett captured a second at Aghaderg Glebe. Natterer's Bat, or Reddish-grey Bat *(Vespertilio Nattereri)*, is very rare, having only been taken twice in the district. Canon Lett captured the first in June 1897 at Aghaderg Glebe, Co. Down; and in July 1900 H. L. Orr sent me one taken at Woodburn Glen, Carrickfergus, Co. Antrim. The Common Bat *(Vesperugo pipistrellus)* is abundant in both counties, and is by far our commonest species. In May 1900 twenty-two living specimens were received from Ram's Island, Lough Neagh. It is not infrequently seen flying on mild days in the middle of winter. The Hairy-armed Bat *(Vesperugo Leisleri)* was first recorded from Ireland by Prof. Kinahan, from two specimens, one shot at Belvoir Park, Co. Down, in 1848, and the other knocked down in Blackstaff Lane, Belfast, June 1858. The latter specimen is still in the Belfast Museum. Though not common, we have notes of its capture near Belfast in 1868, and at Whitehouse in 1898, while Dr. Jameson records it from Langford Lodge, all in Antrim. In Down it has occurred at Newry in 1894 (Jameson); Belmont, 1896; Marino, 1898; and in January 1901 five were taken at the same time in Belvoir Park. (See "The Bats of Ireland," by H. L. Jameson: *Irish Nat.*, vol. vi, 1897, pp. 34–43.)

Insectivora.—Of the five species of British Insectivora, we have only two, the Hedgehog *(Erinaceus europæus)* and

the Lesser Shrew *(Sorex minutus)*. The former is common everywhere, and the latter abundant, though usually overlooked from its small size and retiring habits.

Carnivora.—While the Fox *(Canis vulpes)* is common in the Mourne mountains, it has been practically exterminated in Co. Antrim (see *Irish Nat.*, vol. ix, 1900, p. 275). From ten to twenty are caught in Tollymore Park, Co. Down, every year. There is no fox-hunting in the north of Ireland. The occurrences of the Marten *(Mustela martes)* are peculiar. Not by any means common, it seems to disappear for some years, and then two or three may be taken in a single year. For instance, there are no records of it in Co. Antrim from 1884 to 1893, when three were captured in different places; nor in Co. Down from 1891 (two) to 1899. The Mourne district in Down and the "Glens" of Antrim have yielded most of the local records.

The well-marked variety of the Stoat known as the Irish Stoat or "Assogue" (*Putorius hibernicus* of Thomas and Barrett-Hamilton) is fairly common in both counties, where it is usually called "Weasel," though the true Weasel has never been obtained in Ireland. Even in the north the Irish Stoat seldom turns white in winter.

In the Mournes the Badger *(Meles taxus)* is common, and usually unmolested; and there is a protected colony in Glenarm Park. Around Ballycastle, Badgers are frequently seen; and even so close to Belfast as Belvoir Park one was captured in October 1898. In many places the Otter *(Lutra vulgaris)* is quite common, and is particularly numerous about Downpatrick, Ballycastle, and round Lough Neagh. From a small section of Co. Down we have over 30 records. They are occasionally taken in the sea. The Common Seal *(Phoca vitulina)* is often to be seen round the coast, especially on the Down portion. Thompson refers to 200 to 300 having been seen together off Ballywalter, but they are not so numerous now. Seals of this species occasionally visit Belfast Lough in summer and autumn. The Grey Seal *(Halichœrus grypus)* has also been taken in the district, but is not nearly so numerous here as it is on the west coast.

Rodentia.—The probably introduced Squirrel *(Sciurus vulgaris)* is quite common in certain parts of Co. Antrim—

chiefly the district round Lough Neagh—but it is spreading and increasing rapidly, having been frequently seen at Whiteabbey and Carrickfergus. In Co. Down, though much less numerous, it also seems to be increasing, and has been obtained at Dromore, Ballywalter, and Castlewellan, and lately seen at Hillsborough. (For details of the various introductions in Ireland, see an interesting paper by R. M. Barrington in the *Scientific Proc. Royal Dublin Society*, May 1880.)

The Black Rat *(Mus rattus)* seems to be now quite extinct as a native. Thompson records specimens from Portglenone and Glenravel, Co. Antrim, about 1840 and 1842, and others were reported from Glenarm. Genuine examples of *Mus rattus* have been from time to time taken in Belfast, but have probably been brought over in ships. For example, when a crate containing a consignment of cage rat-traps was opened in a local ironmonger's, a living *Mus rattus* was found in one of the traps. The variety known as *Mus alexandrinus* has been taken in corn-ships at Belfast; and specimens dated 1855 and 1856 are in the Belfast Museum. The Brown Rat *(Mus decumanus)* is common everywhere, and only too well known. The rat described by Thompson as *Mus hibernicus* is now recognised as a dark variety of *Mus decumanus*. (See *Zoologist*, 1891, p. 1.) It has been taken many times in the district and in both counties. The House Mouse *(Mus musculus)* is everywhere abundant. The Wood-Mouse, or Long-tailed Field-Mouse *(Mus sylvaticus)* is also commonly found. So far as is known, the dark variety (the *Mus sylvaticus celticus* of Barrett-Hamilton) has not yet been found on our northern mountains.

The Irish form of *Lepus timidus*, the Variable or Mountain Hare, is common in suitable places, sometimes in large numbers (e.g., in 1880 over fourteen hundred were killed on one estate in Co. Antrim, but this was exceptional). In severe winters many will turn wholly or partially white, but milder weather will keep them the usual colour. White hares are found here both on the hills and the low grounds. Thompson records that about the year 1820 some Brown Hares *(Lepus europæus)* were brought from England and turned out on the largest Copeland Island, off Donaghadee; they did not succeed, and became extinct. (For further

attempts to introduce the Brown Hare into Ireland, see Barrett-Hamilton in *Irish Nat.*, vol. vii, page 69.) The Rabbit *(Lepus cuniculus)* is exceedingly common almost everywhere, and there are some extensive warrens.

Ungulata.—The Red Deer *(Cervus elaphus)*, once common in Ireland, is now extinct, save for one or two protected herds in the south. We have imported Red Deer for a few private parks, such as Castlewellan, Montalto, etc., while the County Down stag-hounds hunt regularly. The other species of British deer still surviving—the Roe Deer *(Capreolus caprea)*—is not a native of Ireland, but Dr. Scharff tells me it has been introduced into counties Sligo and Mayo. The Fallow Deer *(Cervus dama)* has been long introduced, and is kept in private parks, such as Glenarm Park, Shane's Castle, Castlewellan, Seaforde, etc.

Cetacea.[1]—The Common Rorqual *(Balænoptera musculus)* is frequently seen in autumn, and, according to R. Lloyd Patterson *(Irish Nat.*, vol. ix, p. 211), has been observed more often than the Bottle-nosed Whale of late years in Belfast Lough. The only record of the Sperm Whale *(Physeter macrocephalus)* in the district is that of Dr. Molyneux in 1695, stranded in Co. Antrim, near Coleraine (Thompson). The Bottle-nosed Whale *(Hyperoodon rostratus)* is not an uncommon visitor in autumn to Belfast Lough, being locally known as "Herring-hog." The Porpoise *(Phocæna communis)* is common in autumn. The Ca'ing Whale *(Globicephalus melas)* also visits us somewhat frequently: one was captured off Whiteabbey in December 1878, and described by R. Lloyd Patterson in the local papers. It has also been taken on the coast of Down. The Killer *(Orca gladiator)* is rarely seen, but has occurred more than once in the district; e.g., in 1827 and 1868. The White-beaked Dolphin *(Lagenorhynchus albirostris)* has occurred only once, in April 1883, near Donaghadee, County Down (R. Lloyd Patterson in *Field*, 5 May, 1883). The White-sided Dolphin *(Lagenorhynchus acutus)* can be included in our list through one taken at Portrush, County Antrim, in July 1876 (J. D. Ogilby in *Zoologist*, 1876, p. 5077). The

[1] See R. F. SCHARFF on Irish Cetacea. *Irish Naturalist*, vol. ix, pp. 83–91.

Common Dolphin *(Delphinus delphis)* is rare here: one captured near Carrickfergus, in January 1901, is the only record for Belfast Lough. The Bottle-nosed Dolphin *(Tursiops tursio)* has occurred once, in December 1895, cast ashore near Rockport, on the County Down side of Belfast Lough (R. Lloyd Patterson in *Irish Nat.*, vol. ix, p. 211).

R. P.

AVES.

General.—Out of 288 species admitted to the Irish list, the counties of Down and Antrim can claim 231. Of these, 119 have bred in the two counties in the last century, but only 111 are known to breed now. The 231 species may be roughly divided as follows: Residents, 88; summer visitors, 26; autumn and winter visitors, 37; and occasional and irregular visitors, 80.

Of late years much attention has been given to local ornithology, as is shown by the fact that, when the last "Guide to Belfast," etc., was published in 1874, only 185 species could be claimed for the two counties. At that time the Irish list comprised 265 species, but 3 of these have since been struck off. Thus, while 26 birds have been added to the Irish list since 1874, no less than 46 have been added to the local list in the same time.

Much detailed information may be obtained from *The Birds of Ireland*, by Messrs. Ussher & Warren. This valuable and excellent book, published in 1900, admirably does for the last half of the century just closed what Thompson's great work did for the first half. The *Birds, Fishes, and Cetacea of Belfast Lough*, by R. Lloyd Patterson, F.L.S., published in 1881, contains much local information, and may be consulted with advantage.

(The asterisk (*) indicates that the species breeds in the district.)

Passeres.—The *Mistle-Thrush, *Song-Thrush, *Blackbird, *Stonechat, and *Robin are all common residents. In summer the *Wheatear and *Ring-Ouzel are somewhat local; and the *Whinchat is decidedly scarce. Large flocks of Redwings and Fieldfares are found in winter. There are no records of the Redstart since Thompson's time, but

Black Redstarts have been obtained in both counties; the latest at Portaferry, County Down, in November 1899 (Ussher). The *Whitethroat, *Chiffchaff, *Willow-Wren, and *Sedge-Warbler are all common summer visitors; while the *Blackcap and *Garden-Warbler are very rare, and almost unknown. The *Grasshopper-Warbler breeds in both counties, and is increasing.

The *Golden-crested Wren and the *Common Wren are both resident and numerous; but the only record of the Wood-Wren is one observed in the Bog Meadows, near Belfast, on 5 May, 1889. On our mountain streams, the *Dipper is fairly numerous. The *Hedge-Sparrow is one of our commonest birds. The four Tits (*Long-tailed, *Great, *Coal, and *Blue) are common, but the Marsh-Tit has not been obtained since the time of Thompson. In the wooded districts the *Tree-Creeper is fairly common, and has even been taken on Rathlin. Of the Wagtails, the *Pied is common, the *Grey less numerous, and the *Yellow (found only in summer) is confined to one or two places on the shores of Lough Neagh; while the White Wagtail has only been noted once, in May 1902. The *Meadow-Pipit is very common everywhere, and the *Rock-Pipit frequents suitable localities. The Golden Oriole has occurred six and the Great Grey Shrike about ten times; while the only Irish example of the Red-backed Shrike was shot in August 1878 near Castlereagh, Co. Down. The Waxwing has occurred about a dozen times, the last capture being in February 1894; but the Rev. C. H. Waddell informs me that one was seen in January 1901 near Saintfield, Co. Down. The *Spotted Flycatcher is fairly common in summer. The *Swallow, *Martin, and *Sand-Martin are all common in summer, but the last is rather local. The FRINGILLIDÆ are well represented: the *Greenfinch, *House-Sparrow, *Chaffinch, *Yellow-Bunting, and *Reed-Bunting being very common; the *Siskin, *Linnet, *Lesser Redpoll, *Twite, and *Corn-Bunting common; and the *Goldfinch is found locally. The *Bullfinch is increasing in both counties. The Snow-Bunting and Brambling are found in winter in varying numbers, the former being frequently observed on Divis Mountain, above Belfast. The Hawfinch is a very rare winter

visitor, but has been obtained in both counties, the last in December 1897. The Crossbill is a rare visitor; and although Thompson mentions it as having once bred in Co. Down, there is no evidence that it has done so in recent years, though a flock of six, seen in Hillsborough Park at the end of July 1901, may possibly have been reared in the vicinity. The first recorded British specimen of the Two-barred Crossbill was obtained near Belfast on 11 January, 1802; while about 1867 another was killed at Templepatrick, Co. Antrim (Ussher).

The *Starling has increased as a breeding species here to a wonderful extent, but our residents are enormously augmented by the winter immigrants. The Rose-coloured Starling has only occurred three times—all three in Co. Down—and has not been obtained since 1838. On several places in the cliffs of Antrim, the *Chough breeds; but the Mourne mountains appear to be its only stronghold in Down. [The Jay cannot now be included in our list; but in 1900 a gentleman brought over from England a dozen Jays, and liberated them in Down.] The introduced *Magpie, being little molested, is very common, and is increasing; while the *Jackdaw is becoming a nuisance in towns, and has some large colonies in cliffs. The *Raven has still a few breeding-places in both counties, but is getting very uncommon. It has long ceased to breed at the Gobbins. Different observers have reported the Carrion-Crow as visiting the Mourne mountains every spring, and they are *said* to have bred there. A pair has visited Langford Lodge estate every spring for more than twenty-five years; and a recently-killed bird was picked up at Murlough Bay, Co. Antrim, in September 1896 (*Irish Nat.*, 1896, p. 319). But, speaking generally, the Carrion-Crow is little known in Ireland. The *Hooded Crow, or Grey Crow, is abundant in certain places, and breeds regularly in both counties, but is rarely seen in Belfast Lough. The *Rook is very common everywhere, and is increasing. Vast flocks of *Sky-Larks arrive in winter, to reinforce our resident birds. Thompson mentions the Wood-Lark as occurring in Antrim and Down, and states it is "not very uncommon in the warm, sandy district of Malone"; but eight years' residence

in the locality has not enabled me to trace it, and we never heard of one being seen or shot.

Picariæ.—The *Swift is a common summer visitor. The Alpine Swift has occurred once—in 1866—as in May of that year Howard Saunders saw one which had been picked up on the shores of Lough Neagh (*Zool.*, 1866, p. 389). The *Nightjar is fairly common in certain districts; many were observed in the neighbourhood of Belfast in the summer of 1901, but it seems more abundant in Co. Down. The Great Spotted Woodpecker is a very rare winter visitor; about a dozen have occurred in the two counties, the last in 1889. The other British Woodpeckers are quite unknown. The *Kingfisher in many places is not uncommon. We know of a pair breeding regularly within half a mile of the boundary of the city of Belfast; and it is often seen on the shores of Belfast Lough. The Roller is a very rare visitor, the only capture being one near Randalstown in September 1891; but there is a note of one having been seen at Ballykilbeg, Co. Down, by the late Wm. Johnston, M.P., on 8 June, 1868. The Hoopoe is not quite so rare as the last species, about nine being recorded, the last in April 1900 at Glendun, Co. Antrim. In summer the *Cuckoo is common, and heard everywhere. R. M. Barrington records (*Irish Nat.*, vol. x, p. 50) a young Cuckoo killed, striking the lantern on Skulmartin Lightship, off Ballywalter, Co. Down, at the very remarkable date of 26 November.

Striges.—Our only resident Owls are fairly common; the *Long-eared is the more numerous of the two; but from Co. Down the *Barn Owl is more frequently sent in to Belfast to be preserved, the numbers in a given period being—

Down.	Antrim.	
49 Long-eared	41 Long-eared	= 90.
52 Barn	16 Barn	= 68.
101	57	

as shown by an examination of taxidermists' books.

The Short-eared Owl is found in varying numbers in winter, sometimes being fairly abundant, Down again seeming

the favoured county. The Snowy Owl is a very rare visitor, having only occurred about four times, the last in January 1889 at Dundrum. The very rare Scops-Owl has occurred twice—in 1853 and 1883. [The Tawny Owl cannot be included in the Irish list; but in 1900 the same gentleman who brought over the Jays liberated nine Tawny Owls near Belfast, and of these four have been shot, as recorded in the *Irish Naturalist* for 1901, pp. 24, 72, and 230.]

Accipitres.—Although Thompson mentions the Marsh-Harrier as breeding in both counties, it has long ceased to do so, and can now be only regarded as a very rare straggler: one was shot at Cullybackey, Co. Antrim, in September 1897. Almost the same may be said of the *Hen-Harrier, although more specimens are recorded, and a pair is said to have nested near Rostrevor in the nineties (Ussher). The Common Buzzard, which bred in both counties 50 years ago, is now a very rare visitor, although H. C. Hart "saw five on the wing together at the south end of the Mourne mountains" in July 1883 (Ussher). In April and May 1886 a pair was shot near Greyabbey, Co. Down. Lord Antrim notes their decrease since the passing of the "Ground Game Act." The Rough-legged Buzzard has only occurred four times in Co. Down: three about 1831 and one in 1895. Sixty years ago both the Golden Eagle and Sea-Eagle bred in the district, but have been exterminated. There is no recent note of the Golden Eagle, but a female Sea-Eagle was shot at Mountstewart, Co. Down, on 30 January, 1891. It was accompanied by a male bird, which fortunately escaped capture. The *Sparrow-Hawk is resident and fairly common, and the same may be said of the *Kestrel, which breeds on the Cave Hill. The Kite can only be included in our list on the authority of Thompson, who mentions occurrences in 1830 at Glenarm Park, and in 1835 at Shane's Castle. Thompson also records two Honey Buzzards: one in 1833 at Annadale (now absorbed into Belfast) and the other in 1839 on the Antrim shore of Belfast Lough; another was shot in June 1860 near the Belfast Waterworks. The Greenland Falcon has been taken once, in 1865, on Rathlin Island. The *Peregrine has several eyries in the district (two on Rathlin),

and a pair has bred on the Gobbins cliffs from the time of Thompson to the present day. The Hobby was unknown as an Ulster bird until one was shot at Shane's Castle, Antrim, 1 July, 1900 (E. Williams). The *Merlin, though not numerous, is resident in both counties, and even ventures so close to Belfast as the Bog Meadows, where specimens have been shot. The Osprey is very rare, having only been taken in 1851, 1877, and 1891; but in the autumn of 1901 one frequented the eastern shore of Lough Neagh for several weeks, where it was carefully protected.

Steganopodes.—The *Cormorant is well known and is increasing in Belfast Lough, while on Lough Neagh, in June 1900, a flock of 26 and another of 18 were seen within 100 yards of each other. It has several times been reported as breeding on Lough Neagh, but we have not obtained actual proof yet. It used to breed on Rathlin, where its place is now taken by the *Shag, which breeds in some numbers. The Gannet may frequently be seen fishing off our coasts in the summer and autumn months. Its only Irish breeding-stations are in Kerry and Cork (Ussher).

Herodiones.—Frequently seen inland (particularly around Lough Neagh), the *Heron is a common resident on the shores of our loughs, where there are several large heronries; but it is becoming comparatively scarce on Belfast Lough, changes in the natural conditions driving the birds to Strangford and Larne Loughs, where they are increasing. The Night-Heron has only occurred twice, each time in the "People's Park," near Belfast, one in September 1866 and one in October 1893, the latter shot by S. M. Stears: both specimens were immature. We can only include the Little Bittern on the authority of Thompson, who mentions a supposed occurrence in the Bog Meadows, near Belfast, previous to 1830. Once breeding with us, the Common Bittern can now only be regarded as a very irregular winter visitor; but Walter Smyth shot one at Groomsport, Co. Down, on 9th August, 1900. The American Bittern has only occurred once in the district, near Ballynahinch, Co. Down, in November 1883. The Glossy Ibis is a very rare visitor; Templeton records one as shot in the Bog Meadows, mentioned above, in Sep-

tember 1819 (Thompson), and "another was shot out of a flock of six near Bushmills, in autumn 1853" (Ussher). The first Spoonbill recorded in Ireland was shot at Ballydrain Lake, near Belfast, a few years previous to 1808 (Thompson). It has not occurred since in the district.

Anseres.—Although the Grey Lag-Goose probably bred in the Ards district (Co. Down) in the eighteenth century, it is now only a very rare winter visitor. The White-fronted Goose is generally met with in varying numbers each winter; but the Bean-Goose is decidedly local and scarce: it has been shot on Rathlin. The Bernacle Goose is rare; but owing to the next species (Brent) being always called "Barnacle" locally, it is difficult to trace the exact distribution of the true Bernacle. A flock of about 500 Bernacle was observed passing Portrush by Ogilby in March 1876, that probably came from Donegal. The Brent Goose is very common in winter in Larne and Strangford Loughs, sometimes in large flocks, but has recently diminished in Belfast Lough; great numbers are often seen in the local markets. The Whooper Swan has occurred in both counties, but is rare; a flock of 25 has been seen off Rathlin. Bewick's Swan is much more common, and has frequently been obtained; considerable numbers have been seen on Lough Neagh in winter. [The *Mute Swan breeds in several places along the Lagan Canal and also on mill dams and lakes. In hard weather they may be found on marine loughs.]

The ducks are well represented in the district. Sometimes occurring in large flocks in winter, the *Common Sheld-Duck has several breeding-places in both counties: e.g., Strangford Lough, Ballyhornan Bay, mouth of the Bann, and several places on Lough Neagh. The Ruddy Sheld-Duck has only occurred once, in March 1888, when three were seen and one was shot in Strangford Lough. The *Mallard is a common breeding bird, whose numbers are vastly increased in winter, when large flocks may be seen on Lough Neagh. The same may be said of the *Teal, although not so common at any season. Both species breed on Rathlin. The Gadwall is a scarce winter visitor. The *Shoveler, which seems to be increasing in Ireland, has

several breeding-places in Antrim and Down: e.g., Portmore, Clandeboye, and Downpatrick. It is locally called "Spoon-bill," and is fairly common in winter. The Pintail is rarely shot, though we have notes of its occurrence in both counties. It may possibly prefer fresh to salt water in this district. To Thompson we owe the only record of the Garganey, he stating one was seen on Strangford Lough in March 1847. Large flocks of *Wigeon visit us in winter, and many may be seen on Lough Neagh, where a regular "fishery" for all kinds of ducks is carried on. In the summer of 1901 John Cottney had the pleasure of discovering several nests of Wigeon near a small lake in County Antrim, being the first time the eggs had been taken in Ireland. The Pochard occurs commonly in winter (notably on Lough Neagh), and is believed to breed in Antrim. We have seen it at its supposed breeding-haunts in May and June in different years, but its eggs have not yet been taken. The Ferruginous Duck is supposed to have been taken off the Antrim coast once, in March 1871 (Blake Knox). The *Tufted Duck is common in winter, and its eggs have been taken in two different places in Antrim. As it is increasing as a breeding species, it will probably soon be found in Down. Enormous flocks of Scaup-Duck are often to be seen in Belfast Lough in winter, and even Lough Neagh is visited regularly. Not much sought after by gunners, they become comparatively easy to approach. The Golden-eye is common in favourite localities, such as Lough Neagh, in winter, and also occurs in some numbers on our marine loughs. Old males are rare, most of the birds shot being females and young males. The Long-tailed Duck is rare in adult plumage, but young birds have been more frequently seen or shot. We have notes of thirty in Belfast Lough alone, from 1823 to 1901, and it would seem to be almost an annual winter visitor to the north of Ireland: e.g., in 1895, 1896, 1897, 1898, 1899, 1901. Immature birds are not uncommon off Rathlin in winter; while R. Lloyd Patterson saw three mature birds in Belfast Lough in May 1898. A flock of five was seen in Lough Beg, and specimens secured, as recorded by the same gentleman. The Eider Duck is very rare in Belfast Lough, where we only know of three occurrences; but off Rathlin

it is not infrequently seen in winter; and as late as 16 April the lighthouse keepers report "seventeen eider ducks on the water" (Migration Reports). The King-Eider is extremely rare. Thompson records a female shot in Belfast Lough in March 1850. The late Robert Gage of Rathlin stated he shot a female off the island in November 1861, but the specimen cannot be traced; while on 10 November, 1897, the first Irish mature male King-Eider was shot by William H. Shaw near Donaghadee, Co. Down. The Common Scoter is a winter visitor to Belfast Lough in large numbers, flocks of several thousand having been seen; but in other loughs they do not seem to be so numerous. The Velvet-Scoter is very rare. R. Lloyd Patterson observed a pair in February 1875, one was shot in 1886, and I shot a male on 3 January, 1889, out of a flock of three, all in Belfast Lough. Only one specimen of the Surf-Scoter has occurred in the district; the first Irish record is thus given by Thompson: "A beautiful adult male was shot at Ballyholme, Belfast Bay, on 9 September, 1846, by Snowden Corken, Esq.; it was alone. Two of these birds had, a day or two before, been observed in company in the same locality, and one individual was seen several times in the course of a few weeks after the subject of this notice had been killed." This specimen is still in the Belfast Museum. The Goosander is a winter visitor in small numbers; it has been often seen on Strangford, but seems more partial to inland waters and rivers, although it has been obtained more than once on Rathlin. The *Red-breasted Merganser breeds regularly on islands in Strangford (Down), and occasionally on Ram's Island, Lough Neagh (Antrim), and other places, while large flocks are sometimes seen in winter. It seems to be increasing here at all seasons. The Smew is very rare. We only know of five occurrences in the two counties, the last being a female shot by Colonel Bruce on Lough Beg, 22 February, 1901 (R. Lloyd Patterson in *Irish Nat.*, 1901, p. 93). It has several times been taken just outside the district, on Lough Neagh.

Columbæ.—The *Ring-Dove (known as Wood-Pigeon) is very common. A nest has been seen five feet from the ground in a slender tree on Ram's Island. Our residents

are sometimes reinforced by winter immigrants, but not regularly. The *Stock-Dove was first taken in Ireland in 1875 (Co. Down), and two years later bred near Comber, in the same county. In 1889 eggs were taken near Antrim. It has since been found breeding in the Mourne mountains and Hillsborough Park in Down, and at Langford Lodge in Antrim, and will doubtless be found elsewhere in the district. The *Rock-Dove breeds in several places on marine cliffs (e.g., Rathlin and near Ballycastle); and different observers have reported it from the Mourne mountains, whence "Pigeon Rock" gets its name. It has ceased to breed at the Knockagh, above Carrickfergus. The Turtle-Dove is a very rare summer visitor, and does not seem to occur regularly. There are more records from Down than from Antrim.

Pterocletes.—Pallas's Sand-Grouse occurred in the district during the celebrated visitation of 1888. We have notes of nine birds from Killough, Copeland Islands, and Kircubbin (Down), and Crumlin (Antrim).

Gallinæ.—The *Red Grouse is resident and fairly common in both counties, even breeding close to Belfast. [Various attempts to introduce Black Grouse into Antrim and Down have been unsuccessful. See *Irish Nat.*, 1899, p. 37.] The *Pheasant is common where preserved, and in several demesnes very large numbers are reared. It has even wandered to Rathlin more than once. The *Partridge is now very scarce in the district, and rapidly decreasing: chiefly, it seems, through poaching. Common up to about 1860, the *Quail then seemed to become extinct here, and was practically unknown for over thirty years; but within the last ten years Quails have reappeared in small numbers in both counties, and young were obtained. John Brown informs me the call was heard near Annalong in 1900.

Grallæ.—The *Corn-Crake is a very common summer visitor, but it has several times been taken here in mid-winter. The Spotted Crake is rare, having occurred under a dozen times in autumn. The *Water-Rail is a fairly common resident, even breeding on Rathlin; its lurking habits making it appear more rare than it really is. Both

the *Moor-hen (known as Water-hen) and *Coot are resident and very common. The Crane has only occurred once, R. Lloyd Patterson recording in the *Field* that a male was shot 10 May, 1882, near Killyleagh, County Down. (It should be borne in mind that the Common Heron is called "Crane" in the north of Ireland.)

Limicolæ.—The Stone-Curlew has only occurred once. In March 1858 a fine male injured itself by flying against the telegraph wires near "Thompson's Bank," just outside Belfast, on the Northern Counties line, and was captured. It is now in the Belfast Museum, and is the only Ulster specimen known. The Dotterel is a very rare visitor. Thompson records occurrences in (about) 1834, 1841, and 1848, all in County Down; but no more recent visitations are known. The *Ringed Plover is very common; large flocks are to be seen in winter, and numbers breed in many of our bays and islands. Thompson believed that three Kentish Plovers were shot in Belfast Lough in August 1848, but the specimens were not preserved, and there is no more recent record. Breeding on the mountain-plateaus of both counties, the *Golden Plover occurs in large flocks in winter, and, particularly during frost, affords excellent sport. The Grey Plover has become much more scarce in Belfast Lough than formerly, but is found in some numbers in Strangford during the winter. The *Lapwing is resident and very common. The Turnstone occurs in small flocks on our coasts every autumn and winter, and S. M. Stears has seen it in Strangford Lough in June, while I saw five adults on Lough Neagh, 24 May, 1902. The *Oyster-catcher is a common resident, breeding in Strangford Lough and Rathlin, etc., and has several times occurred on Lough Neagh. The Grey Phalarope is an occasional autumn visitor to both counties, and has been obtained on Lough Neagh. The *Woodcock—first known to breed locally in 1834—breeds freely now in many places here, while large numbers visit us in winter. R. M. Barrington's migration records show that many strike the lanterns on the Copeland Island and Maidens lighthouses while arriving. In the autumn of 1901 a Great Snipe was shot in County Antrim, and sent to Messrs. Williams. The *Common Snipe is found in

every suitable place in summer, and our resident birds are greatly augmented in winter. The Jack Snipe is found every winter in moderate numbers. Thompson records the only Irish occurrence of the Broad-billed Sandpiper; viz., on the mud-banks of Belfast Lough, 4 October, 1844. This bird is still in the Belfast Museum. To the same observer we again owe the record of the only occurrence in Ireland of Bonaparte's Sandpiper; viz., Belfast Lough, April 1836. Large flocks of *Dunlin frequent our loughs in winter (they are locally called "Sandlarks"), and a few are known to breed in County Antrim every year, in the Lough Neagh basin. In autumn the Little Stint visits us in small parties, being considered rare enough to be specially noted by the taxidermists. The Curlew-Sandpiper and the Sanderling both occur in small numbers in autumn, more especially in Strangford Lough and Dundrum Bay, but are usually overlooked owing to their diminutive size. While the Purple Sandpiper occurs in small numbers in winter, the Knot is common, and large flocks are sometimes met with. The Knot is locally known as "Grey Plover." The Ruff is a rare autumn visitor, and is little known. It has occurred more frequently in Down than Antrim, and R. Lloyd Patterson saw a male in breeding plumage near Downpatrick, at the unusual date of May, in 1901. The second Irish-killed Buff-breasted Sandpiper was shot by Mr. Joyce in the "People's Park," Belfast, in October 1864, and is now in the Belfast Museum. It has not occurred in Ireland since. The *Common Sandpiper is very common in suitable localities in summer. It is especially numerous all round Lough Neagh. The Green Sandpiper is a rare visitor. We have only eleven records for the two counties; the last in 1887. The *Common Redshank is abundant in winter, and many pairs breed with us, particularly near Lough Neagh The Spotted Redshank has only been obtained once, at Holywood, County Down, in August 1823 (Thompson); but R. Lloyd Patterson believes he saw another at Ballymacormick Point on 4th November, 1876 (*Birds, etc., of Belfast Lough*, p. 182). The Greenshank is a winter visitor in small numbers, and but little known. Of the Godwits, the Bar-tailed is an autumn visitor in limited numbers, few remaining over the

winter with us; while the Black-tailed is very rare. Breeding in small numbers on our bogs and mountains, the *Common Curlew is well known in our loughs in winter, large flocks being frequently seen. The Whimbrel is fairly common in May, and on its return journey in autumn is also met with. It has even occurred so late as October in more than one instance.

Gaviæ.—The Black Tern is a very rare straggler. We only know of six occurrences, the last being near Downpatrick, 23 October, 1863. The Sandwich Tern is also rare here, the most recent note being 12 September, 1893, at Newcastle, Co. Down. In Thompson's time the Roseate Tern bred in some numbers on the Copeland Islands, off Donaghadee. The *Guide to Belfast, etc.* (1874) states they bred there still but were gradually diminishing; they have long ceased to breed there, and are now quite unknown, although Ussher states (*Birds of Ireland*, p. 318) that three were seen in Belfast Lough in August 1890, but this is the only recent occurrence known. The *Common Tern and *Arctic Tern are both very numerous in summer, breeding freely round our coast in large numbers, while the Common breeds also on Lough Neagh. The *Little Tern breeds in small numbers in Strangford Lough, and is frequently sent up from there. Thompson had the pleasure of adding Sabine's Gull to the British fauna, by describing a specimen shot in Belfast Lough in September 1822; another was obtained in the same place in September 1834; the third (and last) in October 1867, off Bangor, Co. Down (Blake Knox). Thompson also added Bonaparte's Gull to the British fauna, the only Irish specimen being shot on the River Lagan, "between Ormeau Bridge and the Botanic Gardens," 1 February, 1848. It is still in the Belfast Museum. The Little Gull is extremely rare; only four occurrences are known, the last in 1849 (Thompson). The *Black-headed Gull is the most numerous gull we have. It breeds in numbers on Lough Neagh and other lakes. With us the Common Gull belies its name; though found in small numbers round our coast, it is anything but common, and does not breed in the district; however, it has been seen in June on Lough Neagh. The *Herring-Gull is

very common, and breeds in large numbers on Rathlin and the Gobbins. S. M. Stears has taken the eggs in Strangford Lough; and in July 1901 Nevin Foster and I discovered the first *inland* breeding-place in Ireland, on one of the Antrim hills. The *Lesser Black-backed Gull is resident, but nowhere numerous; it breeds among the Antrim hills and on Rathlin, and is sometimes seen on Lough Neagh, where it used to breed. The Great Black-backed Gull is met with in small numbers, usually in autumn and winter, and does not breed in the district; it rarely comes inland, but has been shot on Lough Neagh. The Glaucous Gull and Iceland Gull are both rare winter visitors, the former being more often obtained, having occurred about a dozen tines. Rathlin Island is the only place in the district where the *Kittiwake Gull breeds. It has an immense colony there, and immature birds are common all round the coast in the summer. Thompson records six Great Skuas in Belfast Lough—three shot and three seen—in 1848, but it has never been recorded since. The Pomatorhine Skua is an autumn visitor in small numbers, chiefly immature birds. It is not very uncommon on Rathlin in winter. Richardson's Skua is rather more frequent, and adult birds have frequently been obtained in autumn. Summer occurrences are rare, but two were shot in Belfast Lough, 1 June, 1863. Buffon's Skua occurs irregularly in autumn in small numbers: one was obtained in May 1892 in a bog near Ballymoney, both date and place being most unusual.

Alcæ.—*Razorbills and *Guillemots breed in countless numbers on Rathlin Island, and are very common in our loughs in summer. In winter they are not often seen. Rarely found inland, H. D. M. Barton has recorded the Razorbill from Lough Neagh. The extinct Great Auk can only be included in our list through the discovery by W. J. Knowles, of Ballymena, of a number of its bones in the kitchen-middens of Whitepark Bay, Co. Antrim. Full particulars will be found in the *Proceedings* of the Royal Irish Academy, 3rd Series, vol. i, No. 5, p. 625; vol. iii, No. 4, p. 654; vol. vi, No. 3, p. 336. It would seem as if Great Auks must have been easily procurable by pre-historic

Bones of Great Auk.
Whitepark Bay, Co. Antrim.

man, and used for food, and the interesting question arises as to the possibility of ancient breeding-places having existed near Whitepark Bay. Professor Newton considers that the Skerries, off Portrush, would have been a suitable place; and no doubt the gentle slopes of Church Bay, in Rathlin, would have offered no difficulty to a flightless bird.

The *Black Guillemot frequents our loughs in small numbers, and breeds on Rathlin, where it remains all the year. The Little Auk is an uncommon straggler in winter, and is more frequently picked up inland after a storm than obtained on the coast. It is considered rare in Strangford. The *Puffin breeds in very large numbers on Rathlin, and is found in varying numbers in our loughs in late summer and early autumn. In winter it is almost unknown.

Pygopodes.—The Great Northern Diver is found in limited numbers in winter. The 8th August is the earliest date R. Lloyd Patterson has seen this bird in Belfast Lough, but he informs me that in June 1884 he saw four which had been accidentally caught in nets at Newcastle, Co. Down. The same gentleman has only seen four Black-throated Divers in Belfast Lough. It is a very rare winter visitor. The Red-throated Diver is the most common of the three. It is frequently seen in autumn and winter; and R. Lloyd Patterson regards it as a regular spring visitor to our loughs on migration. He has seen one at the very early date of 18th July in Belfast Lough.

The *Great Crested Grebe breeds in some numbers on Lough Neagh, Hillsborough Park, and other places. It rarely visits salt water in the north of Ireland, probably owing to the great expanse of Lough Neagh; but occasionally odd birds have been shot in Larne and Belfast Loughs. The Red-necked Grebe is extremely rare, not having been recorded since 1850 (Thompson). The Slavonian Grebe is a rather uncommon winter visitor. We have notes of over a dozen occurrences on the coast and several on Lough Neagh. The Eared Grebe is another rare member of the family, only six specimens being recorded, the last from Doagh, Co. Antrim, in 1868 (Blake Knox in *Zoologist*). The *Little Grebe is resident and common, breeding in many ponds and lakes, even on Rathlin. In winter it occa-

sionally comes to the sea, and in January 1889 a dozen were seen together in Larne Lough.

Tubinares.—The *Storm-Petrel breeds in one or two islands off the Antrim coast, but it is chiefly known here as an uncommon straggler after a storm. Many were found inland after the storm of September 1891, and it is not very uncommon to see single birds on Lough Neagh in autumn. It is rarely seen on Belfast Lough. The Fork-tailed Petrel is only known as a rare visitor after storms; many were picked up locally after the great storm of November 1881, and in September 1891 still more were killed by the storm. This great storm also brought us the second Irish example of Wilson's Petrel. This exceedingly rare wanderer was captured alive in a field at Mossvale, Co. Down, near Dunmurry, on 2 October, 1891, and is now in the possession of E. J. Charley, of Seymour Hill, Dunmurry. The only claim the Great Shearwater has to a place on our list rests upon one which was observed by R. Lloyd Patterson outside Strangford Lough on 11 June, 1887. The Sooty Shearwater has only been obtained twice in Ireland: our local specimen was shot off Bangor, Co. Down, on 29 September, 1869, by J. R. T. Mulholland. First announced as a Great Shearwater, it was afterwards recognised to be a Sooty Shearwater, and is in the possession of R. Lloyd Patterson. Rathlin Island is the only place in our district where the *Manx Shearwater is known to breed; but from July to October it is frequently seen in our loughs, and may be regarded as a regular autumn visitor. The Fulmar is very rare, having only occurred three times; the last on Rathlin, 2 September, 1889.

Appendix I.

Birds which have wandered to our district, but are not now admitted to the Irish list:

American Black-billed Cuckoo.—The only specimen ever obtained in the British Isles (and second in Europe) was shot by Dr. Rea of Belfast, in the parish of Killead, Co. Antrim, 25 September, 1871.

Egyptian Goose.—Has been obtained in a few instances in both counties.

CANADA GOOSE.—Several have been shot apparently wild, but they are kept in a semi-domesticated condition at Castlewellan and Hillsborough, Co. Down, and probably other places.

YELLOW-BILLED SHEATHBILL.—A specimen of this Antarctic bird was shot at Carlingford Lighthouse, Co. Down, on 2 December, 1892, and is now in the collection of R. M. Barrington (*Zoologist*, 1893, p. 28; *Irish Nat.*, 1893, p. 151).

APPENDIX II.

Birds on the Irish list which have *not* been taken in the district. (Figures in brackets show approximate number of occurrences, taken by permission from Ussher's *Birds of Ireland*.)

White's Thrush (3)
Lesser Whitethroat (1)
Barred Warbler (2)
Yellow-browed Warbler (1)
Rufous Warbler (1)
Icterine Warbler (1)
Red-throated Pipit (1)
Woodchat Shrike (1)
Pied Flycatcher (7)
Red-breasted Flycatcher (4)
Serin (1)
Tree-Sparrow
Mealy Redpoll
Lapland Bunting (1)
Jay
Crested Lark (1)
Short-toed Lark (1)
Wryneck (6)
Green Woodpecker (3)
Lesser Spotted Woodpecker (7)
Bee-eater (8)
Great Spotted Cuckoo (2)
Griffon-Vulture (1)
Montagu's Harrier (8)
Spotted Eagle (1)
Goshawk (3)
Iceland Falcon (2)
Red-footed Falcon (1)
Lesser Kestrel (1)
Purple Heron (1)
Little Egret (3)
Squacco Heron (8)
White Stork (3)
Pink-footed Goose (1)
Snow-Goose (7)
Red-crested Pochard (1)
Hooded Merganser (5)
Little Crake (1)
Baillon's Crake (2)
Little Bustard (6)
Pratincole (1)
Lesser Golden Plover (1)
Sociable Plover (1)
Avocet (13)
Black-winged Stilt (6)
Red-necked Phalarope (1)
American Pectoral Sandpiper (1)
Temminck's Stint (1)
Bartram's Sandpiper (2)
Spotted Sandpiper (1)
Wood-Sandpiper (4)
Red-breasted Snipe (2)
Eskimo Curlew (1)
White-winged Black Tern (6)
Whiskered Tern (1)
Noddy Tern (1)
Ivory Gull (2)
Little Dusky Shearwater (1)

R. P.

REPTILIA.

It is a common saying that "there are no reptiles in Ireland," and using the word in the plural sense, the saying is correct. But we have one reptile, the Brown Lizard *(Lacerta vivipara)*, fairly abundant throughout the country, but seldom seen owing to its protective colouring and great agility if accidentally disturbed. It is more abundant on the Mourne mountains than elsewhere, and may often be seen basking on the sun-warmed granite. In June 1860 "vast numbers" appeared everywhere in County Down, as recorded in the *Zoologist* for that year, p. 7172.

R. P.

AMPHIBIA.

The Frog—*said* to have been introduced about the year 1700—is common everywhere, even on the tops of our mountains. In March 1894 an immense assemblage of frogs—estimated at from 500 to 1,000—were observed at Lough Bingian in the Mournes (*Irish Nat.*, vol. iii, p. 115). Several attempts to introduce the frog into Rathlin Island have failed.

(The Natterjack Toad is only found in County Kerry, and the Common Toad is unknown in Ireland.)

In Ireland we have only one species of Newt *(Molge vulgaris)* out of the three British species. The Common Newt is found in ditches, ponds, brickworks, and quarries all over the district, and is fairly abundant. Local name, "man-keeper."

(The two other species have been from time to time reported, but authentic specimens have never been produced).

British species not found in Ireland :

Sand Lizard.	Common Toad.
Blindworm.	Edible Frog.
Ringed Snake.	Warty Newt.
Viper.	Palmated Newt.
Smooth Snake.	

R. P.

PISCES.

Little work has been done among the marine and fresh-water fishes of the district since the publication of the fourth volume of Thompson's *Natural History of Ireland* in 1856; the only local book containing later information being *The Birds, Fishes, and Cetacea of Belfast Lough*, by R. Lloyd Patterson, F.L.S.; but it only deals with about fifty marine fishes, which may be more or less commonly met with. The section dealing with fishes in the British Association Guide of 1874 was almost wholly derived from Thompson's above-mentioned volume. J. Douglas Ogilby published a valuable series of notes in the *Zoologist* on fishes of the Portrush district, and my acknowledgments are due to all the above sources of information. To Dr. R. F. Scharff, of the National Museum in Dublin, my thanks are especially due for much assistance and helpful suggestions freely given. The pages of *The Irish Naturalist* contain notes on Irish fishes, and should be consulted.

ARRANGEMENT AND NOMENCLATURE FOLLOWED.

Dr. Francis Day; *The Fishes of Great Britain and Ireland*, 2 vols. 1880–84.

TELEOSTEI.

ACANTHOPTERYGII.

Perca fluviatilis. Perch.—Locally common, but not found everywhere. Large numbers are caught in Lough Neagh and rivers flowing into it.

Labrax lupus. Bass.—Rare in the north of Ireland, and solitary examples usually obtained. Ogilby records one of 13¾ lbs. at Portrush, and Thompson one of 14 lbs. from Belfast Lough, but these weights are quite exceptional.

Cantharus lineatus. Black Sea-bream.—Very rare; first recorded Irish specimen was taken in May 1846 off Cultra Point, Belfast Lough.

Pagellus centrodontus. Common Sea-bream.—Abundant; called "Carp" in Belfast Lough, and "Brazier" at Portrush.

Cottus scorpius. Large Bull-head.—Common.

C. bubalis. Long-spined Bull-head.—Common.

Trigla lineata. Streaked Gurnard.—The first Irish record was from Strangford Lough; it is taken annually in small numbers.

T. cuculus. Red Gurnard.—Common round the coast.

T. hirundo.—In the north of Ireland called "Grey Gurnard." Common.

T. gurnardus.—Locally called "Knowd," and the commonest of the gurnards here, especially in autumn; R. Lloyd Patterson having caught 161 in a day's fishing, on hand lines, in Belfast Lough.

Agonus cataphractus. "Armed Bull-head."—Occasionally taken in trawls; often found in stomachs of Cod.

Lophius piscatorius.—The Angler Fish is not uncommon here. Ogilby records one from Portrush 5 ft. 7 in. long, which contained a fresh Ling of 8 lbs. weight; while Thompson mentions that a fresh Wigeon was taken from one in Larne Lough.

Trachinus vipera.—The Lesser Weever is sometimes quite abundant. Ogilby records one of the unusual length of $6\frac{1}{8}$ inches, taken at Portrush.

Scomber scomber.—The Mackerel is usually common from July to September, but at intervals it appears to almost forego its annual visits. It is capricious in its movements, being sometimes abundant at one place and scarce a few miles off. R. Lloyd Patterson has caught 354 in a day by "streaming."

Orcynus thynnus.—The Tunny is rare. In the autumn of 1841 a large specimen came ashore in Ballyholme Bay, Bangor, Co. Down; it measured 8 ft. 3 ins. in length, 5 ft. 4 ins. in girth, and weighed fully 300 lbs. (Thompson). Ogilby records another which stranded itself at Portrush, 1 September, 1878; its length was 8 ft., girth 5 ft. 1 in., weight estimated at from 3 to 4 cwts. It was probably one of a shoal.

Brama Raii. Ray's Bream.—Although Thompson very properly threw doubts on the correctness of McSkimmin's statement regarding this fish, it can now be included in the list, as Ogilby obtained one at Portrush in July 1878. It was washed ashore dead, and was 15 inches long.

Schedophilus medusophagus.—The first specimen recorded from the British seas was taken by Ogilby at Portrush in August 1878. It measured 9½ inches, and was taken in a salmon net.

Lampris luna.—The Opah, or King-fish, is very rare. Thompson records one which was captured in Belfast Lough, off Whitehouse, 2 July, 1850. It is still preserved in the Belfast Museum.

Caranx trachurus.—The Scad is very uncertain in its visits, but in some years (e.g., 1878 and 1881) vast shoals appear. The numbers which came ashore near The Gobbins in 1881 were so enormous that the farmers on Island Magee manured their fields with them. (R. Lloyd Patterson.)

Zeus faber. John Dory.—Not at all common about Portrush, and very rare in Belfast Lough.

Gobius Ruthensparri.—The Double-spotted Goby is fairly common. Thompson found it especially numerous along the shores of Down.

G. niger.—The Black Goby has been obtained in a few instances.

G. minutus. Freckled Goby.—Common in sandy bays.

Callionymus lyra. Dragonet. — Not uncommon; females are more frequently taken than males.

Cyclopterus lumpus.—The Lump-sucker is occasionally taken round the coast, but is never common. Thompson records one 2 3½ inches long from Portaferry, Co. Down.

Liparis Montagui.—The Diminutive Sucker has been taken off both counties in small numbers.

Lepadogaster Gouanii. — Thompson records the Cornish Sucker from Portrush.

L. bimaculatus.—The Bimaculated Sucker is not uncommon in Belfast and Strangford Loughs; has also been taken at Larne and off St. John's Point.

Anarrhichas lupus.—Templeton records a Wolf-fish taken in Belfast Lough in 1807; but Thompson never knew of one in his time, and there are no more recent records.

Blennius gattorugine. Gattoruginous Blenny. — Ogilby states that it is not rare at Portrush, but it is uncommon elsewhere. Has been taken at Carrickfergus and Carnlough.

B. pholis.—The Shanny is common in rocky pools round the coast.

Carelophus Ascanii.—Yarrell's Blenny was added to the Irish list by Thompson, from specimens taken at Carrickfergus in May 1839. Ogilby records two from Portrush in 1875, taken in crab-pots, and obtained many examples there in the two following years.

Centronotus gunnellus.—The Butter-fish is very common and has many local names, such as "Nine-eyes," "Coddick," "Flutterick," etc.

Atherina presbyter.—The Atherine, or Sand-Smelt, is common in Strangford Lough and Portrush harbour, but appears to be somewhat local. It has been frequently sent up as the Smelt *(Osmerus eperlanus)*, which has not been obtained in Ireland.

Mugil chelo. Lesser Grey Mullet.—Very common, and often taken in considerable numbers. *M. capito* is unknown here.

Gasterosteus aculeatus. Three-spined Stickleback.—Very common.

var. **trachurus.**—Common.

var. **semiloricatus.**—Extremely rare. Donaghadee and Rathlin, only British records.

var. **semiarmatus.**—Very rare. Rathlin, Wolfhill.

var. **gymnurus.**—The commonest inland form. Swarms in Lough Neagh.

var. **brachycentrus.**—Rare. Belfast, Lough Neagh.

var. **spinulosus.**—Rare. Belfast.

G. pungitius.—The Ten-spined Stickleback is comparatively rare. It has been obtained in the Blackstaff, and at Portaferry (Thompson), Owen O'Cork Marsh (H. L. Orr), and it has been taken round Lough Neagh.

G. spinachia.—The Fifteen-spined Stickleback, or Sea Stickleback, is found around the coast. It is called "Horn-eel" at Portrush (Ogilby).

Labrus maculatus.—The Ballan Wrasse is common, and has many local names, such as "Bavin," "Merrin," "Gregagh," etc. Examples up to 8 lbs. weight have been taken at Donaghadee.

L. mixtus.—According to Ogilby the Striped Wrasse

is not uncommon at Portrush, but in Belfast and Strangford Loughs it is decidedly rare.

Crenilabrus melops.—The Gilthead is, next to the Ballan Wrasse, the most common species around the coast.

Ctenolabrus rupestris.—Thompson records a few specimens of Jago's Goldsinny from Belfast Lough, but there are no recent records.

Centrolabrus exoletus.—The Small-mouthed Wrasse is rare; it has been taken at Carnlough.

ANACANTHINI.

Gadus morhua.—The Cod is common, and has local names for various stages of growth.

G. æglefinus.—The Haddock is found in varying numbers; very common at Killough, frequently got in Belfast Lough in small numbers, and common in Larne Lough, while for ten years they disappeared from the Portrush district. Thompson records one of 25 lbs. weight from Groomsport.

G. luscus.—The Pout (locally called "Braize") is common.

G. minutus.—The Poor or Power Cod is common, and is also known as "Braize." R. Lloyd Patterson has caught 100 in a day.

G. merlangus.—The Whiting is common, but varies greatly in different years and also in different places in the same year. For instance, while R. Lloyd Patterson caught none in Belfast Lough in 1877, in that year they became abundant off Portrush, according to Ogilby.

G. virens.—The Coal-fish possesses more local names than any other fish here, and is very common. "Cudden," "Pickie," "Blockan," "Glashin," "Stanlock," "Grey-lord," are a few of its names according to size. Thompson records one of 32 lbs. weight.

G. pollachius.—The Pollack (locally called "Lythe") is common; and Ogilby records one of 21½ lbs. weight from Portrush.

Merluccius vulgaris.—The Hake is rare here.

Phycis blennoides.—The Greater Fork-beard is extremely rare. It has been taken near Carrickfergus in 1812,

1836, 1839, and 1840, and at Portaferry in 1849 (Thompson), while one taken off the Co. Down coast in 1886 was sent to R. Lloyd Patterson.

Molva vulgaris.—The Ling is fairly common; but while there is a regular fishery for them at Portrush, in Belfast Lough Ling are only occasionally got. Thompson records one of 59 lbs.

Motella mustela.—The Five-bearded Rockling is found around the coast, but is nowhere very numerous.

M. tricirrata.—The Three-bearded Rockling is comparatively uncommon in Belfast Lough, but Ogilby states it is plentiful about Portrush; much more so than *M. mustela*.

Raniceps raninus.—The Lesser Fork-beard, or Tadpole-Hake, is very rare. Thompson records one from Donaghadee, 1837, and Ogilby met with three at Portrush; viz., 1875, 1876, and 1878. All four examples were washed ashore dead.

Fierasfer dentatus.—The first British example of this exceedingly rare fish was picked up by Dr. J. L. Drummond at Carnlough, Co. Antrim, in June 1836, and was fully described by Thompson, *Trans. Zool. Soc.*, ii, p. 207, under the name of Drummond's Echiodon.

Ammodytes lanceolatus.—The Greater Sand-eel is common in sandy bays, especially on the coast of Down. "About two days after a severe north-westerly gale which occurred in January 1876, large numbers of this species were found on the east strand, Portrush, about 50 yards above high-water mark, buried in the sand, from which their heads protruded about an inch, being driven in by the violence of the waves."—Ogilby, in *Sci. Proc. R.D.S.*, vol. iv, 1885, p. 522.

A. tobianus.—The Small Sand-eel is more numerous than the preceding species; large quantities are taken on the sandy shores of Down. Enormous numbers must be destroyed by sea-birds.

Hippoglossus vulgaris.—The Halibut is only occasionally taken in Belfast Lough, and a few are caught yearly at Portrush on the cod-lines. Thompson mentions one of over 300 lbs. taken at Ballywalter, Co. Down.

Rhombus maximus.—The Turbot is very rare in Belfast Lough, but commoner further north, especially Portrush district, and also off Co. Down coast.

R. lævis.—Much the same may be said about the Brill, which seems more numerous than Turbot, except at Portrush, where Ogilby states the two species to be about equal. Local name, "Britt."

Zeugopterus unimaculatus.—The very rare Bloch's Topknot is recorded by Thompson as having been taken by dredging in Belfast Lough in June 1838 and August 1844.

Z. punctatus.—Müller's Topknot is also very rare. Thompson got one at Ardglass, Co. Down, in 1835; Ogilby obtained one at Portrush in April 1876 and another in August 1877; and R. Lloyd Patterson received one from Bangor, Co. Down, in July 1902. (*Irish Nat.*, vol. xi, p. 186.)

Arnoglossus megastoma.—The Whiff is occasionally taken off both counties, but is not at all common. Local name, "She-sole."

Pleuronectes platessa.—The Plaice is one of the most abundant of our flat-fishes. Examples of 10 and 12 lbs. have been obtained here.

P. microcephalus.—The Lemon Dab is not uncommon, but is not taken in large numbers.

P. cynoglossus.—The Pole (local name, "White Sole") is not commonly taken, and only one or two at a time; but in 1839 about 190 were taken in one haul off Newcastle, Co. Down: this was quite exceptional (Thompson).

P. limanda.—The Dab is very commonly taken, usually of small size.

P. flesus.—The Flounder, or Fluke, is also very common.

Solea vulgaris.—Almost unknown now in Belfast Lough. Soles are common elsewhere; very large specimens are sometimes taken at Portrush (Ogilby).

S. lascaris.—The Lemon Sole is rare here; one was caught off Bangor, Co. Down, in May 1897 (R. Lloyd Patterson).

S. variegata.—The first occurrence of the Variegated Sole in Ireland was recorded by Thompson, being a single specimen taken by Dr. J. L. Drummond at the entrance

to Belfast Lough, in June 1838. It has not been noticed here since.

S. lutea.—The Little Sole is very rare; three were taken by Thompson and Hyndman off Dundrum, Co. Down, in August 1836; four by Dr. Drummond in Belfast Lough, June 1838; and by McCalla off the coast of Down about 1840 (Thompson).

PHYSOSTOMI.

Salmo salar.—The Salmon is common, and there are several productive fisheries: the Bann and Bush rivers are specially noted; a few are caught in Lough Neagh and rivers therefrom.

S. trutta.—The Sea-trout is known in the north of Ireland as "White Trout," and is abundant on the coast, ascending almost all the rivers, even those of small size. The variety *S. cambricus* is also abundant; and Ogilby points out that we have of this a long-headed and short-headed form, the latter being as a rule females.

S. fario.—The Common Trout (Brown Trout) is abundant in almost all our rivers and lakes.

var. **S. ferox.** Great Lake-trout.—Common in Lough Neagh, where one weighing 36 lbs. has been taken; often from 20 to 25 lbs.

var. **S. estuarius.** Estuary Trout.—Not uncommon at river mouths.

var. **S. stomachicus.** Gillaroo Trout.—Not uncommon in Lough Neagh, where it sometimes attains 12 lbs. weight.

[**S. alpinus.**—The Charr used to be common in Lough Neagh, where old fishermen still speak of it as the "White Fish" of their fathers; but about 1824 they disappeared from the lake entirely. Although Thompson offered a handsome reward for one in 1837, he failed to obtain a specimen.]

Coregonus pollan.—This is the most interesting fish of the district, as it is not known outside Ireland, although two closely-related species (the Vendace and the Gwyniad) are found in the freshwater lakes in the Lake district in England, and in Wales. Our Pollan has been

known as resident in Lough Neagh for over 180 years; but Thompson was the first to draw attention to the specific differences between it and the two English species above-mentioned, in a paper read before the Zoological Society of London in June 1835, when he named it *Coregonus pollan* (Thompson). It has been found in a few other Irish lakes not in our district. Ogilby points out (*Sci. Proc. R.D.S.*, vol. iv, 1885, p. 529) that Pollan also occur in salt or brackish water, and mentions the estuary of the Bann and the estuary of the Foyle as being well-known resorts, giving interesting particulars of the latter colony. The Lough Neagh fishery is a most important one, as may be inferred from the following figures, kindly supplied by Mr. Andrew King, the resident inspector:

POLLAN.

Year.	Tons Exported.	Av'ge Value per Ton.			Total Value.			No. of Men Employed.
		£	s.	d.	£	s.	d.	
1897	396½	16	0	0	6,344	0	0	474
1898	406½	16	0	0	6,508	0	0	476
1899	201½	16	0	0	3,244	0	0	470
1900	447½	16	0	0	7,160	0	0	506

These are shipped chiefly to London, Birmingham, Leeds, Liverpool, and Manchester. The three "close" months are November, December, and January. In July 1851 Thompson took about 100 *Mysis relicta* from the stomach of a Pollan from Lough Neagh. This small shrimp-like crustacean has not been found in the British Islands out of Ireland.[1]

Esox lucius.—The Pike is common; large examples are taken in Lough Neagh.

Belone vulgaris.—In Belfast Lough the Garfish is rarely got now, but in Strangford Lough and off Portrush it is common during the autumn, being used for bait.

Scombresox saurus.—The Saury Pike is rarely obtained, but a few are recorded from both counties.

[1] See illustration under heading Crustacea.

[**Cyprinus carpio.**—The introduced Carp is to be found in various ponds, and the Gold-fish *(Carassius auratus)* flourishes in many mill-dams.]

Gobio fluviatilis.—The Gudgeon is found in various rivers, and is fairly common in Lough Neagh.

Leuciscus erythrophthalmus.—The Rudd is common in our rivers and lakes; it is usually called "Roach." [NOTE.—It is noteworthy that neither the Roach, Chub, nor Dace occurs in Ireland.]

L. phoxinus.—The Minnow is local in its distribution, being rare in some places, while Ogilby found it abundant in the Main river and Kellswater, Co. Antrim.

Tinca vulgaris.—The Tench is local and nowhere common.

Abramis brama.—The Bream is found in many rivers, and is common at certain seasons in Lough Neagh, where it is caught in the trout-nets.

Clupea harengus.—The Herring is uncertain in its visits, and of late years the Ardglass fishery has sadly diminished. In 1874 Ardglass possessed a fleet of about 400 herring boats, all fully employed; now there are only about 100, and very few are local boats. The value of the fish caught thirty years ago would be about £80,000 per annum; now it is barely £10,000 per annum on the average.

C. pilchardus.—With us the Pilchard is merely a straggler, but it has been occasionally taken in Belfast Lough, and the same may be said of the Sprat *(C. sprattus)*.

C. alosa.—The Allis Shad is decidedly rare; one was taken off Holywood in August 1888 (R. Lloyd Patterson) and one off Donaghadee early in 1896 *(Irish Nat.*, vol. v, p. 191).

C. finta.—The Twaite Shad is also very rare, but has been taken in Belfast Lough and off Newcastle.

Anguilla vulgaris.—The Eel fishery is probably one of the most important in the district. Large quantities are taken in the Bann in the autumn months (Thompson mentions 70,000 in one night at Toome) while they are on their way to the sea, and more are caught on long-lines and draft-nets in Lough Neagh.

1900.

	Boxes of 112 lbs.	Price per Box.	
Toome Eel Fishery Exported ...	1,300	£3 0 0	= £3,900
Portna Eel Fishery ditto ...	400	2 10 0	= 1,000
Lough Neagh Eel Fisheries ditto	2,700	2 0 0	= 5,400
		Total	£10,300

Toome Eels are of more value than Lough Neagh Eels, because the fish are mature when caught. London, Birmingham, Leeds, Liverpool, and Manchester are the principal markets for these Eels. The above figures have been kindly furnished by Mr. Andrew King, Toome Bridge.

Conger vulgaris.—The Conger is common everywhere, and regularly fished for. Ogilby records one of 58½ lbs. and another of 53 lbs. at Portrush.

LOPHOBRANCHII.

Siphonostoma typhle.—The Broad-nosed Pipe-fish is very rare here, one specimen having been taken in Larne Lough in 1836 (Thompson).

Syngnathus acus.—The Greater Pipe-fish is rare on the north coast, as Ogilby only obtained one; but Thompson obtained it more commonly by dredging in Belfast and Strangford Loughs.

S. rostellatus.—In the *Irish Naturalist* for November 1898, p. 258, E. W. L. Holt adds the Lesser Pipe-fish to the Irish list, and states that the Dublin Museum possesses a specimen from Portrush, presented by Ogilby.

Nerophis æquoreus.—The Ocean Pipe-fish is certainly the most common species in the north, and has been frequently taken.

N. ophidion.—The Straight-nosed Pipe-fish is only known through Thompson, who records one in October 1847 from Strangford Lough, and one in October 1851 from Carrickfergus.

N. lumbriciformis.—The Worm Pipe-fish has been frequently taken.

Hippocampus antiquorum.—The Sea-horse has been obtained in a very few instances; e.g., Red Bay and Belfast Lough.

PLECTOGNATHI.

Orthagoriscus mola.—The Short Sun-fish is rare usually, but in 1871 and 1876 it appeared in some numbers. Specimens have been taken at Bushfoot, The Gobbins, Groomsport, Ardglass, Portrush, and Belfast Lough, usually in autumn.

CHONDROPTERYGII.

GANOIDEI.

Acipenser sturio.—The Sturgeon—our single living representative of the old Ganoid fishes—is occasionally taken round the coast. While rare in Belfast Lough, about a dozen are annually got in more northern salmon-nets (Ogilby). In December 1849 one of $4\frac{1}{2}$ ft. was taken close to the County Down railway station in Belfast (Thompson).

ELASMOBRANCHII.

Carcharias glaucus.—The only local note of the Blue Shark is one caught by R. Lloyd Patterson (*Birds, Fishes, etc., of Belfast Lough*, p. 227). It was between five and six feet long.

Galeus vulgaris.—The Tope is not uncommon at Portrush (Ogilby), but elsewhere it is only occasionally obtained; and the same may be said of the Smooth-hound (*Mustelus vulgaris*).

Lamna cornubica.—Only one occurrence of the Porbeagle here is on record (viz., 7 July, 1815), taken in a herring-net at Carrickfergus; length, 5 ft. 11 ins. (Thompson).

Alopias vulpes.—The Fox-Shark, or Thresher, has been reported as "seen" on different occasions (McSkimmin, Templeton, Patterson), but the first one actually captured was taken in a salmon-net at Portrush, 16 June, 1876. It was 4 ft. 9 ins. long. (Ogilby in *Zool.*, 1876, p. 3049.)

Scyllium canicula.—The Small-spotted Dog-fish is abundant, and comes next to the "Picked Dogs" in numbers. It is commonly eaten by the poorer classes about Portrush. (Ogilby.)

S. catulus.—The Large-spotted Dog-fish frequents the north-east coast, but is comparatively rare. Ogilby only obtained two at Portrush.

Pristiurus melanostomus. — The Black-mouthed Dog-fish is very rare; Thompson records two taken at Portrush, but gives no date.

Acanthias vulgaris.—This fisherman's pest, the Picked Dog-fish, is sometimes very abundant, and is by far our commonest species. Ogilby describes (*Zool.*, 1876, p. 4904) how the Cod and Ling fishery of Portrush was almost totally ruined that season by the enormous numbers of Dog-fish, and R. Lloyd Patterson has taken 118 in the course of an afternoon's fishing in Belfast Lough.

Rhina squatina.—The Monk-fish is very rare here; Thompson mentions five occurrences. I have a photograph of one over 6 ft. long, taken at Portrush, September 1888; John Brown wrote me of one he caught in July 1890 in Dundrum Bay, 4 ft. 2 ins. long; and R. Lloyd Patterson records one taken off Cultra, Belfast Lough, September 1901, 1 ft. 9½ ins. long (*Irish Nat.*, 1901, p. 230).

Raia batis.—Fairly common in Belfast Lough, the Grey Skate seems to be more numerous further north. Large examples of 6 and 7 feet long are sometimes taken.

R. alba.—The White Skate is very rare; Thompson found the remains of an immense specimen at Annalong, County Down, in September 1851.

R. fullonica.—The Shagreen Ray is not uncommon at Portrush, but elsewhere it is not well known.

R. clavata.—The Thornback Ray is common, and is taken in enormous numbers near Portrush, being shipped fresh to the Liverpool market (Ogilby).

R. maculata.—The Spotted Ray is almost as common as the preceding, but is considered here worthless as food.

R. circularis. — Not uncommon on the bank off Portrush, where Ogilby caught ten Sandy Rays in eleven months.

Cyclostomata.

Petromyzon marinus.—The Sea Lamprey is not uncommon in certain places, but is not used, and is generally little known.

P. fluviatilis.—The River Lamprey is found in Lough Neagh and its rivers, and other rivers in the district. It is

usually looked upon with disgust, and regarded as highly dangerous.

Tunicata.

The Tunicates still remain one of the least known groups of the local fauna, and in the present state of our knowledge no attempt can be essayed at giving an account of them.

R. P.

INVERTEBRATA.

MOLLUSCA.

Marine Mollusca.

The coast of Ireland has been divided for zoological purposes into six districts, of which the Antrim and Down shores belong in part to two—to District I, which extends from Malin Head in Donegal to St. John's Point in Down; and to District II, which stretches from St. John's Point to Carnsore Point in Wexford. Compared to most of the Irish waters, our district has been well explored. The more important work may be divided into three epochs: 1. Work done by William Thompson and his contemporaries, both shore-collecting and dredging, and published in his *Natural History of Ireland* in 1856. 2. Dredgings carried out about Belfast and Strangford Loughs by G. C. Hyndman, George Dickie, E. Waller, and J. G. Jeffreys in 1857–1859, under grants from the British Association, and published in the Reports of the Association for those years. 3. Dredgings carried out by G. W. Chaster, L. E. Adams, J. R. Hardy, R. Standen, and R. Welch around Rathlin Island in 1896–1897, and published in the *Irish Naturalist*. The results obtained in Ulster up to 1888 were summarized by R. Ll. Praeger in *Proc.* B.N.F.C for that year; while the publication in 1900 by A. R. Nichols of his *List of the Marine Mollusca of Ireland* gives a complete account of the subject. The coast-line of the district presents a considerable variety of conditions. In both Down and Antrim there are extensive sandy beaches; in other places shingle prevails. Estuarine conditions and mud-flats are not uncommon; and while low rocky shores prevail in Down, high cliffs are a feature of the

coast of Antrim. The coast offers all degrees of exposure and shelter, from North Antrim, open to the Atlantic, to the land-rocked lough of Strangford. Bathymetrical conditions are also varied: the water deepens to 70 or 80 fathoms in most places, while off Rathlin Island a rocky depression sinks to 133 fathoms. The seas of our district are the coldest in Ireland, and the mollusca have a distinctly northern facies, some 36 species being unknown or very rare north of Britain, while about 18 have a southward range. Of the northern shells, *Acmæa (Tectura) testudinalis*, *Emarginula crassa*, *Trichotropis borealis*, *Trophon clathratus*, *Nuculana (Leda) minuta*, and *Crenella decussata* have all been taken alive in our waters; while of the southern forms *Circulus striatus* (*Trochus Duminyi*), *Lunatia* (*Natica*) *sordida*, *Ovula patula*, and *Barbatia (Arca) lactea* will serve as examples. The most remarkable features of the area are the very extensive and northern fauna, made up chiefly of dead shells, of the Turbot Bank, which lies in about 30 fathoms off Belfast Lough; and the surprising richness of the 15 to 17 fathom ground discovered by Dr. Chaster's party inside of Rathlin Island, where a single day's dredging yielded one species new to science and two more new to Britain.

In estimating the total fauna, it is difficult to state figures exactly, as doubt exists whether a few of the Turbot Bank shells should not rather be classed as quaternary fossils. But leaving these doubtful items out of account, we may reckon the molluscan fauna at 330 species, made up as follows:

Cephalopoda	...	...	...	9
Amphineura	...	...	...	9
Gastropoda	...	...	...	190
Scaphopoda	...	...	...	2
Pelecypoda	...	...	...	120
		Total	...	330

The Irish molluscan fauna (0–100 fathoms), reckoned similarly, totals about 470 species, to which are to be added 67 species more, which are confined to the deep-water district (100–1,000 fathoms), which zone may be considered as unrepresented in our area.

The rarest species in the local fauna is the Nudibranch *Lamellidoris ulidiana*, found by Mr. Thompson on oysters from Down or Antrim, and not known elsewhere. Two—*Homalogyra atomus* var. *polyzona*, and *Lamellodoris muricata*—are, so far as at present known in the British Isles, confined to our district—the first to Antrim, the second to both counties. Three more Antrim species—*Turbonilla pusilla* var. *delicata*, *Lepton obliquatum*, and *Nuculana pusilla*—though found elsewhere in Ireland, are unknown in Great Britain. The list of Down and Antrim Mollusca unknown elsewhere on the Irish coast numbers eight species:

N Craspedochilus (Chiton) albus.
N *Scissurella crispata.
S Homalogyra atomus *var.* polyzona.
S Jordanula (Odostomia) truncatula.
Galvina (Eolis) tricolor.
N Lamellidoris (Doris) muricata.
Lamellidoris ulidiana.
*Lima elliptica.

Of these, the species which are of distinctly northern or southern range are distinguished by the letters N or S respectively; the two marked thus (*) have also been dredged in deep water off the west coast.

In giving a brief indication of the distribution of the rarer species, a division according to the two counties which compose the district is not satisfactory, so many species having been taken in Belfast Lough, which lies between Down and Antrim. A tripartite division into North, Mid, and South has therefore been adopted. Mid (M), signifies the Belfast Lough area, stretching, say, from the Maiden Rocks to the Copeland Islands; N, the waters north of this; S, the waters south of it. Where the names in the following list of rarer species differ from the familiar ones of Jeffreys' *British Conchology*, the latter, whether generic or specific, are added in parenthesis.

List of Rarer Species.

N M Spirula Peronii *Lamk.*
M Rossia macrosoma (*delle Chiaje*).
M S Todaropsis (Loligo) Eblanæ (*Ball*).

N M Hanleya (Chiton) hanleyi (*Bean*).
M S Craspedochilus (Chiton) albus (*L.*).
M S Tonicella marmorea *(Fabr.)* (Chiton marmoreus).
N M S Acmæa (Tectura) testudinalis (*Müll.*).
N M Lepeta (Tectura) fulva (*Müller*).
N M S Propilidium ancyloide (*Forbes*).
N M Puncturella Noachina (*L.*).
M Emarginula conica *Sch.* (E. rosea).
M E. crassa *J. Sowerby.*
N M Scissurella crispata *Fleming.*
S Monodonta crassa (*Montfort*) (Trochus lineatus).
N Circulus striatus (*Phil.*) (Trochus Duminyi).
N M Ianthina rotundata *Leach.*
N M S Pherusina (Aclis) Gulsonæ (*Clark*).
N Cima (Odostomia) minima *Jeffreys.*
N M S Trichotropis borealis *Brod. and Sow.*
N Homalogyra atomus *var.* polyzona (*Brus. MSS.*).
M Rissoa albella *Lovén.*
N Adeorbis imperspicuus *Monterosato.*
N A. unisulcatus *Chaster.*
M Cerithiopsis concatenata *Conti* (C. pulchella).
M Ovula patula (*Pennant*).
N M Jordanula (Odostomia) truncatula (*Jeffreys*).
M Odostomia conspicua *Alder.*
M Brachystomia (Odostomia) albella (*Lovén*).
N Turbonilla pusilla *var.* delicata (*Monterosato*).
N M Eulimella (Odostomia) Scillæ (*Scacchi*).
N M S Trophon muricatus *var.* barvicensis *Johnston.*
N M Tornatina (Cylichna) nitidula (*Lovén*).
N M Philine angulata *Jeffreys.*
M P. quadrata (*S. Wood*).
M Galvina (Eolis) tricolor (*Forbes*).
M Tritonia Hombergii *Cuvier.*
M T. plebeia *Johnston.*
S Triopa claviger (*Müller*).
M S Lamellidoris (Doris) muricata (*Müller*).
M L. ulidiana (*Thompson*).
N Nuculana pusilla (*Jeffreys*).
M Barbatia (Arca) lactea (*L.*).
N M S Crenella decussata (*Mont.*).

M Pecten clavatus (*Poli*) *var.* septemradiatus.
N Montacuta donacina *S. V. Wood.*
N Lepton obliquatum *Monterosato.*
N Galeomma Turtoni *Sowerby.*
M Barnea (Pholas) parva (*Pennant*).
M Zirfæa (Pholas) crispata *L.*
N M Pholadidea loscombiana *Goodall* (P. papyracea).

The group of Mollusca which is least known in our district, and which most requires working at, is the Nudibranchs. Out of 56 species recorded as Irish (a number far from complete), only 15 have been detected in our area. The fact that one or two of these are extremely rare suggests that a rich harvest may await the investigator.

References.—Nichols: A List of the Marine Mollusca of Ireland, 1900 (*Proc.* R. I. Academy (3) v, No. 4). Chaster: A Day's Dredging off Ballycastle, Co. Antrim, 1897 (*Irish Nat.*, vi, 120). *Ibid.:* Notes on the Marine Mollusca of Rathlin Island, 1897 (*t. c.* 184). Praeger: The Marine Shells of the North of Ireland, 1889 (*Proc.* B.N.F.C., 1887–8, appendix). Hyndman: Reports of the Belfast Dredging Committee, 1857–9 (*British Assoc. Reports*, 1857–9). Thompson: Natural History of Ireland, iv, 1856.

R. Ll. P.

Land and Freshwater Mollusca.

Antrim and Down, with their great diversity of surface features and a very varied coast-line, provide numerous "sanctuaries" for the Terrestrial Mollusca, which are only too few in many counties more generally cultivated, and less broken up by glens and valleys. Fairly large areas in the Glens of Antrim, which are deep vales cutting into the basaltic plateau or the old schists, are much too rough and steep for cultivation. Many are talus slopes from the basalt or chalk above, covered with natural thickets of Hazel, Holly, and Mountain Ash, shading a deep mossy sward below. Apart from these there are also many thickly-wooded little ravines, mainly in the larger glens, on the slopes of the Belfast hills, or at the head of the many marine gullies round the coast. These have usually a dense undergrowth of *Luzula maxima* and a rough moss-covered talus of chalk, basalt, or schist débris, moist even in the driest summer weather, ideal habitats for many of the Land

Mollusca, and it is here that so many of the rarer species of *Hyaliniæ* and *Helices* abound.

It was in these glens that William Thompson collected so often for his lists of the Irish fauna. Colin Glen, near Belfast, especially is repeatedly mentioned in his *Natural History of Ireland*, and forty species may still be found there. The late Prof. Ralph Tate, the founder of the Belfast Naturalists' Field Club, collected frequently there also. His finds in the Belfast district are often noted in his work on *British Mollusks*.

It is due largely to the number of these little rough habitats that the district can claim as natives fully two-thirds of the species of Land and Freshwater Mollusca that inhabit Britain; for the central area of Antrim is a high and in many places bare tableland, with many peat bogs and few lakes or old woods, while the greater part of Down is well cultivated, or in the southern portion covered largely with granite mountains and bog, areas which have a poor molluscan fauna. Though the glens of Down, in Ordovician rocks mainly, are fewer, and their land fauna hardly as rich as those of Antrim, the former county has a more plentiful and generally distributed freshwater fauna. This is mainly due to the number of old cut-away bogs in the low ground—areas from which the available peat has long since been removed—with their multitudes of drains, marshes, ponds, and flax-pools. Where latter are situated in marshy ground, the heaps of stones that usually surround them shelter during the winter sometimes large colonies of *Vertigo antivertigo* and *V. pygmæa*, with *Hyalinia nitida*, *H. fulva*, and *H. radiatula*. The Lagan river and canal separating north Down and south Antrim, and the Newry canal between south Down and Armagh, also assist very materially the Down fauna; the former being the main habitat of *Anodonta cygnea*, a scarce species in the district, and the latter of *Amphipeplea glutinosa*, which is both very local and rare in Ireland. Some old woods in Down, though not large in area, have a fauna hardly less rich in species than the Antrim glens. Belvoir Park, near Belfast, is a good example of these. In a few yards square at the Galwally pond may be found *Hyalinia radiatula* var. *viridiscenti-alba*,

Limax marginatus, *Helix lamellata*, *Pupa anglica*, *Vertigo substriata*, *Limnæa auricularia*, and very large *Sphærium corneum*, with about twenty other species.

In Antrim the freshwater species are more local. In the central parts of the county suitable habitats are not so plentiful as in Down, but this is fully compensated for by the fact that the largest lake in Britain (Lough Neagh), with its continuation Lough Beg, and the river Bann from that to the sea, bound the county entirely on the west. For some time past sub-committees of the Royal Irish Academy and Belfast Naturalists' Field Club have been steadily making a survey of Lough Neagh fauna and flora. Several additions to the mollusca of the lough, and indeed of the district, have been made, including *Hydrobia (Paludestrina) Jenkinsi* and *Sphærium lacustre*, while many interesting forms of common species, including some of Pisidia from deep water (87 feet), have been dredged or collected along the margin. The above, with the sand dunes, which are extensive on some parts of the coast, and the maritime marshes at the heads of estuaries in Larne, Belfast, Strangford, and Carlingford Loughs, are the main habitats of the L. and F.W. Mollusca of the north-east of Ireland.

Of the 117 species known to live in Ireland, 96, including 59 land and 37 fresh or brackish-water species, are found in Antrim or Down.

About 25 British species seem absent from Ireland; and 4 species—*Geomalacus maculosus*, *Limnæa involuta*, *Pisidium globulare*, and *P. hibernicum*—found in Ireland, are absent in England and Scotland.

In the following list Scharff's nomenclature is used as given in his *List of the Irish Land and Freshwater Mollusca*, 1892, and later additions:—

Land Species.

Vitrina pellucida, *Mull.*
Hyalinia cellaria, *Mull.*
H. alliaria, *Miller.*
H. nitidula, *Drap.*
Hyalinia crystallina, *Mull.*
Arion ater, *L.*
A. subfuscus, *Drap.*
A. hortensis, *Fér.*

Arion circumscriptus, *Johnst.*
Limax maximus, *L.*
L. marginatus, *Mull.*
Agriolimax agrestis, *L.*
Helix rotundata, *Mull.*
H. hispida, *L.*
H. nemoralis, *Mull.*
Helix aspersa, *Mull.*
Cochlicopa lubrica, *Mull.*
Pupa cylindracea, *Da C.*
Clausilia bidentata, *Strŏm.*
Succinea putris, *L.*
Carychium minimum, *Mull.*

The above are generally distributed in both counties, and they are mostly abundant where they occur. *Helix nemoralis* and *H. aspersa* are more plentiful along the coast than inland. This is especially the case on the dunes near Portrush, Ballycastle, and Newcastle.

The following 27 species are more local and usually less plentiful; a few however, especially the Helices and some Vertigos which inhabit the dunes, are found in very large numbers; the latter sometimes collected in "pockets," as described by R. Standen in *Irish Naturalist*, vol. vi, p. 8. *V. edentula* on sea banks near Ballycastle, and *V. antivertigo* in many marshes, are very plentiful some years in late summer. Species marked with an asterisk (*) are strictly confined to the coast, mainly the dunes, though the Helices are, in central Ireland, found right across the Limestone Plain.

Hyalinia pura, *Alder.*
H. radiatula, *Alder.*
H. fulva, *Mull.*
H. nitida, *Mull.*
Arion intermedius, *Normand.*
Agriolimax lævis, *Mull.*
Amalia Sowerbyi, *Fér.*
A. gagates, *Drap.*
Helix pygmæa, *Drap.*
*H. pulchella, *Mull.*
H. aculeata, *Mull.*
H. fusca, *Mont.*
H. arbustorum, *L.*
*H. virgata, *Da C.*
*Helix intersecta, *Poir.*
*H. ericetorum, *Mull.*
*H. acuta, *Mull.*
Pupa anglica, *Fér.*
*P. muscorum, *Mull.*
Vertigo edentula, *Drap.*
V. pygmæa, *Drap.*
V. substriata, *Jeffr.*
V. antivertigo, *Drap.*
*V. angustior, *Jeffr.*
Balea perversa, *L.*
Succinea elegans, *Risso.*
Acme lineata, *Drap.*

11 species are very local and scarce: *Hyalinia Draparnaudi*, Beck (see Adams, Refers.) *H. contracta*, West, *Limax flavus*, L., and *Helix lamellata*, Jeff., are confined to a few stations; *H. rupestris* to two localities on Antrim coast, *H. sericea* to one in Antrim, and *H. hortensis* to one in Down; *H. rufescens*, though common in South Down, is local in North Down and rare in Antrim. *Buliminus obscurus* is local near Belfast and Larne; *Vertigo alpestris* has been found only at Whitepark Bay (Standen, *loc. cit.*) and outside the district very sparingly at only two places, both on north coast; *Vertigo pusilla*, Colin Glen and Whitepark Bay, rare.

Fresh and Brackish-water Species.

Limnæa peregra, *Mull.*
L. palustris, *Mull.*
L. truncatula, *Mull.*
Physa fontinalis, *L.*
Planorbis marginatus, *Drap.*
P. spirorbis, *L.*
P. contortus, *L.*
P. albus, *Mull.*
Ancylus fluviatilis, *Mull.*
Bythinia tentaculata, *L.*
Hydrobia ulvæ, *Penn.*
Valvata piscinalis, *Mull.*
V. cristata, *Mull.*
Sphærium corneum, *L.*
Pisidium pulchellum, *Jenyns.*
P. fontinale, *C. Pfr.*
P. milium, *Held.*
P. obtusalis, *C. Pfr.*
P. pusillum, *Gmel.*

The above are generally distributed, and some are exceedingly common; the majority plentiful in the Bann, the Lagan, or Lough Neagh. The following are distinctly local or rare species: a few, however, like *Aplexa hypnorum* or *Hydrobia Jenkinsi*, usually occur in very large numbers wherever found:

Alexia denticulata, *Mont.*
Melampus bidentatus, *Mont.*
Amphipeplea glutinosa, *Mull.*
Limnæa stagnalis, *L.*
L. auricularia, *L.*
Aplexa hypnorum, *L.*
Planorbis carinatus, *Mull.*
P. glaber, *Jeffr.*
P. crista, *L.*
Planorbis fontanus, *Lightf.*
Ancylus lacustris, *L.*
Hydrobia ventrosa, *Mont.*
H. Jenkinsi, *Smith.*
Sphærium lacustre, *Mull.*
Pisidium amnicum, *Mull.*
P. nitidum, *Jenyns.*
Unio margaritifer, *L.*
Anodonta cygnea, *L.*

The following 21 species, which are found in other parts of Ireland, are absent from Antrim and Down; they are mostly confined to the southern counties or some limited areas on the Great Central Plain:

Hyalinia helvetica, *Blum.*
H. excavata, *Bean.*
Geomalacus maculosus, *Allman.*
Testacella maugei, *Fér.*
T. haliotidea, *F. Big.*
T. scutulum, *Sow.*
Helix pisana, *Mull.*
Cœcilianella acicula, *Mull.*
Vertigo minutissima, *Hartm.*
V. moulinsiana, *Dup.*
Clausilia laminata, *Mont.*
Succinea oblonga, *Drap.*
Otina otis, *Turt.*
Limnæa involuta, *Harvey.*
L. glabra, *Mull.*
Planorbis corneus, *L.*
P. vortex, *L.*
Neritina fluviatilis, *L.*
Pisidium globulare, *West.*
P. henslowianum, *Shepp.*
P. hibernicum, *West.*

Limnæa glabra and *Paludina vivipara* are excluded from the district list, and the latter also from the Irish, with some species recorded on insufficient evidence (see Scharff's notes, *op. cit.*). The usual varieties of most species occur, and though true albinos are excessively rare, colonies containing a fair proportion of white-shelled forms of *Pupa anglica*, *P. cylindracea*, *P. muscorum*, *Clausilia bidentata*, and *Acme lineata*, with a few *Helix rotundata*, are found on the north coast of Antrim. A small high-spired form of *Helix nemoralis* is plentiful at Killard Point, Co. Down.

References.—Thompson: Natural History of Ireland, iv, 1856. Tate: Land and Freshwater Mollusks of Gt. Britain, 1866. Scharff: The Irish Land and Freshwater Mollusca, *Irish Naturalist*, i, 1892. Additions, *ibid.*, iv, p. 335, and per Phillips, iii, p. 45. Adams: Manual of British L. and F.W. Shells, 1896. Adams: L. and F.W. Mollusca Ballycastle District, *Irish Naturalist*, vi, 1897, p. 179; also see vii, 1898, p. 82. Standen: The Land Mollusca of Ballycastle and District, *Irish Naturalist*, vi, 1897, p. 1. Welch: County Records, *Journ. of Conch.*, ix, p. 111.

R. W. and H. L. O.

ARTHROPODA.

Insecta.

The counties of Antrim and Down present a very diversified surface. Mountain, plain, lake and sea-shore, bogs and cultivated lands, are all to be met with within their borders. It might well be expected that such diversity would produce a very large number of insects of all orders; and such, no doubt, would be the case were the whole tract thoroughly examined. Unfortunately, these two counties, like so much of Ireland, have not been fully investigated with reference to their insect fauna. Our knowledge is consequently limited—in fact, it is very limited; for except as regards the Coleoptera and Lepidoptera, exceedingly little is known of the insects of Antrim and Down, while even in these two orders much has yet to be learned.

W. F. J.

HYMENOPTERA.

Such information as we possess of the Hymenopterous fauna of the districts round Belfast is almost entirely due to the researches of the eminent entomologist, the late A. H. Haliday. No one seems to have paid much attention to this interesting group of insects in recent years, so that the subject—so far as it concerns the counties of Antrim and Down—remains practically as Haliday left it some fifty years ago. The elaborate papers which he published on the parasitic sections of the Hymenoptera[1] are still indispensable works of reference to students of these obscure groups. Amongst the higher aculeate sections, however, the records are extremely scanty, and the remarks in connection with the Haliday collection of Hemiptera apply equally to the present order. The following short list contains practically all of the species for which definite local records are available. At least four of these (marked with an asterisk) have not been found elsewhere in Ireland

[1] A. H. Haliday.—An Essay on the Classification of the Parasitic Hymenoptera of Britain, which correspond with the Ichneumones minuti of Linnæus, *Entom. Mag.*, vols. i–v, 1833–1838 (and other papers).

up to the present time; the localities for these have been obtained in Haliday's MS. list of Irish Insects. *Salius fuscus* (taken by the late R. Patterson at Falls Road on 14 April, 1831); **Spilomena troglodytes* (taken near Holywood by Haliday); **Fassalœcus monilicornis* (at Shane's Castle); **Gorytes mystaceus* (Holywood, in May and June); *Mellinus arvensis; Crabro tibialis* (has occurred in County Down); *C. leucostoma* (Dundrum sandhills); *C. palmipes* (Belfast); *Oxybelus uniglumis* (Dundrum); *Vespa rufa* (Shane's Castle); *Sphecodes dimidiatus* (road to Ardglass, August 1829, R. Patterson); *Halictus rubicundus; H. albipes; Andrena Trimmerana; A. cinerea* (this very local bee has been found at Cranmore, Ram's Island, Loughbrickland, and Rostrevor); *A. nigroœnea* (near Belfast); *Nomada ruficornis; Bombus cognatus; B. sylvarum* (Portballintrae); *B. lapidarius;* and *B. terrestris.* It will be seen that a wide field for discovery awaits local entomologists, and it is to be hoped that satisfactory reports on the Ants, Bees, and Wasps will soon be forthcoming.

Amongst the Sawflies (*Tenthredinidæ*) little work has been done. A few species are recorded, with localities, in Haliday's MS. list, all from the neighbourhood of Holywood; namely, *Selandria flavens*, *Athalia lugens*, *Heptamelus ochroleucus* (a rare species found on oak near Holywood), *Dolerus pratensis*, and *Xyela julii.* In addition to these, three others have been found about Belfast, all of them more or less injurious species. These are *Nematus ribesii* (causing injury to Gooseberry). *Lophyrus pini* (the Pine Sawfly[1]). This destructive species has been noticed in three separate localities in the immediate neighbourhood of Belfast, where it seems to have confined its attacks to the Austrian Pine; but, fortunately, the insect has not occurred in sufficient numbers to cause any serious injury. The Giant Sawfly (*Sirex gigas*[2]) has been frequently found during recent years both in Antrim and Down, and seems to be on the increase.

J. N. H.

[1] R. L. PRAEGER.—The Pine Sawfly (*Lophyrus pini*) in the North of Ireland. *Irish Naturalist*, ii, 1893, p. 55.

[2] R. L. PRAEGER.—*Sirex gigas* in the North of Ireland. *Irish Naturalist*, ii, 1893, p. 113.

DIPTERA.

The neighbourhood of Belfast is classic ground to the student of the Two-winged Flies, as the scene of the early researches of one of the most talented and accurate of entomologists—Alex. H. Haliday. Seventy years ago his observations on the shores of Belfast Lough and the slopes of the Mourne mountains enabled him to publish the most important paper on Irish Diptera[1] that has ever appeared. In this paper he enumerated more than 650 species, many of which proved to be the types of new species, and some of new genera. In the introduction to this paper Haliday dwelt on some features of the Irish fly fauna that are especially marked in Ulster. For example, he commented on the absence of Asilidæ and Bombyliidæ (a few representatives of these families do occur in the south), and the relative abundance of Dolichopodidæ and certain groups of the Acalypterata—especially the families Cordyluridæ and Phycodromidæ of modern dipterologists. All the species of *Scatophaga* and *Cœlopa*, for example, noted as British in Verrall's List,[2] were recorded from the Belfast district by Haliday 70 years ago! The abundance of *Cœlopa* was specially noticed by Haliday, who pointed out the poorness of the genus in species on the European coasts. Flies of the sea-shore are undoubtedly well represented in Ireland: they may perhaps be regarded as belonging to the more ancient sections of the fauna, since the insects that have taken to life on the tidal margin would appear to be decadent types, no longer able to hold their ground among the more favourable inland conditions. Besides sea-shore flies of such comparatively large size as the Cœlopæ, Haliday detected near Belfast Lough some minute but very interesting species, such as *Grenanthe ripicola* and *Atissa pygmæa*.

Practically nothing has been added to our knowledge of the Dipterous fauna of the Belfast district since Haliday's time. It must have been a "happy hunting-ground" for

[1] A. H. HALIDAY.—Catalogue of Diptera occurring about Holywood in Downshire. *Entom. Mag.*, vol. i, 1833, pp. 147–180.

[2] G. H. VERRALL.—A List of British Diptera. London, 1888.

students of this order of insects during the first half of the century, for the late Robert Patterson has given an interesting account of swarms of small Crane-flies (*Erioptera trivialis*) and Midges (*Chironomus testaceus*) that appeared near Belfast in June 1842.[1] From 200 to 300 columns, composed of these frail insects, were visible at the same time, each column rising vertically above trees to a height of from 30 to 60 feet.

In view of the interest lately aroused in gnats of the genus *Anopheles* as carriers of malarial infection, it may be noteworthy that all three of the British species are included in Haliday's list of 1838.

G. H. C.

LEPIDOPTERA.

There are many excellent localities in the district for Butterflies and Moths. The coast sand-hills at Portrush, Portballintrae, Dundrum, etc., are the resort of *Argynnis aglaia*, *Satyrus semele*, several species of *Agrotis* (e.g., *A. lucernea*), with other Noctuæ, *Gnophos obscurata*, *Crambus warringtonellus*, etc. In a good season Lepidoptera are plentiful; and as the ground has not been exhaustively investigated, there is every probability of good things turning up which are not noted here. Ballycastle is noted as the abode of *Nyssia zonaria*, which may be taken there plentifully in the early part of April. At Island Magee, and in the neighbourhood of Carrickfergus, we may find *Lycæna minima*, *Vanessa cardui*, *Nemeophila plantaginis*, *Eupithecia constrictata*, *Phycis subornatella*, *Peronea Schalleriana*, etc. Colin Glen is a good collecting-ground, with a considerable variety in vegetation and surface. Among those recorded from this locality we may note *Macroglossa bombyliformis*, *Lophopteryx camelina*, *Thyatira batis*, *Dianthœcia nana*, *Anticlea badiata*, *Cidaria silaceata*. The hills about Belfast, Divis, the Black Mountain, etc., yield several good species, the most interesting, perhaps, being the rare Plume, *Platyptilia isodactyla*. Some nice Noctuæ occur, e.g., *Noctua glareosa*, *Celæna Haworthii*, *Agrotis strigula*, and among the Geom-

[1] R. PATTERSON.—Note on the Appearance of Clouds of Diptera. *Ann. Mag. Nat. Hist.*, vol. x, 1842, p. 6.

etræ, *Phibalapteryx lapidata*. The Mourne mountains, owing to their great extent, are very difficult for any but a resident collector to deal with. In a district of this kind one has to find out the particular spots frequented by the insects, and without this knowledge a collector might spend a whole day with very little result. Unfortunately, there is no resident collector, so that not very much has been done. The larva of *Clostera curtula* has been found in the valley above Bloody Bridge; *Phycis fusca*, in the Happy Valley; and *Pamphusia mercuriana*, on the top of Slieve Bingian, at an elevation of 2,400 feet. An old record gives Rostrevor as a locality for *Lycæna ægon*, but it has not been met with recently. *L. argiolus* occurs in Donard Demesne; and in the same locality, *Hyelophila prasinana*, *Hepialus hectus*, *Hadena adusta*, *Venusia cambrica*, *Melanthia albicillata*, and *Olindia ulmana*. These are some of the chief localities in Antrim and Down for Lepidoptera; others will be found noted in the following lists.

Of casual visitors we may note *Vanessa antiopa*, captured many years ago by Canon Bristow near Belfast; *Sphinx convolvuli*, recorded from Glenarm; and *Deilephila livornica*, taken in Ormeau Park. It is somewhat remarkable that the only *Zygæna* recorded is the common *filipendulæ*. *Z. loniceræ* occurs quite commonly in Co. Armagh, on the very borders of Down, and there seems to be no reason why it should not occur in Antrim and Down. In the list which follows I have only noted some of the more interesting species. I have availed myself of the list of the Lepidoptera taken in the Belfast district by C. W. Watts, Mr. Kane's List of Irish Lepidoptera, and Mr. Barrett's work on the Lepidoptera of the British Islands.

Gonepteryx rhamni, *L.*—"On the 4 of July, 1829, I watched one for some time on the quay of Belfast; but as a crowded wharf is a place but ill adapted for racing after butterflies, I had to allow the unusual visitant to escape, but not until I had been several times so near as to preclude the possibility of any mistake as to the insect."—*Insects mentioned in Shakespeare*, by the late R. Patterson, F.R.S.

Argynnis aglaia, *L.*—Portrush, Portballintrae, Dundrum, Bryansford.

A. paphia, *L.*—Shane's Castle, the Ards, Tollymore Park, Donard Demesne.

Vanessa io, *L.*—Loughbrickland, Lisburn, Knockbreda.

V. antiopa, *L.*—A specimen captured by Rev. Canon Bristow, in 1872, sitting on a stone wall about two miles from Belfast.

V. cardui, *L.*—Near Antrim town, Portballintrae, in the townland of Loughadian, Co. Down, near Poyntzpass, M'Art's Fort, Island Magee.

Satyrus semele, *L.*—Portstewart, Portrush, Portballintrae, the Knockagh near Carrickfergus, Newcastle.

L. argiolus, *L.*—Donard Demesne, near Newcastle.

L. minima, *Fues.*—Between Carrickfergus and Whitehead, very abundant on Island Magee.

Acherontia atropos, *L.*—Carrickfergus, Lisburn, Ballycastle, Cushendun.

Sphinx convolvuli, *L.*—Glenarm.

Deilephila livornica, *Esp.*—In Ormeau Park, Belfast; two specimens taken at rhododendron flowers, June 1888.

Smerinthus ocellatus, *L.*—Belfast.

Macroglossa bombyliformis, *Esp.*—Colin Glen, Crawfordsburn.

Sphæcia bembeciformis *Hüb, Lewin.*—Knockbreda, and near Scarva, Co. Down.

Nudaria mundana, *L.*—Newcastle; scarce.

Pæcilocampa populi, *L.*—Shane's Castle, Larne.

Clostera curtula, *L.*—Newcastle; larvae found in July 1883.

C. reclusa, *Fab.*—Newcastle; larvæ on willow on Mourne mountains.

Cymatophora duplaris, *L.*—Ballycastle.

Leucania conigera, *Fb.*—Belfast marshes.

Hama abjecta, *Hb.*—Meadows at top of Belfast Lough.

Mamestra persicariæ, *L.*—Rostrevor.

Apamea ophiogramma, *Esp.*—Marsh near Belfast.

Celæna Haworthi, *Curt.*—Common on the Belfast hills; Ballycastle.

Agrotis præcox, *L.*—Portrush, Portballintrae, Dundrum.

A. strigula, *Thnb.*—Belfast hills; abundant.

A. lucernea, *L.*—Sand-hills at Dundrum.

Noctua glareosa, *Esp.*—Ballycastle, Black Mountain near Belfast; abundant.

Tæniocampa opima, *Hb.*—Belfast, both pale form, and var. *brunnea*, Tutt.

Orthosia lota, *Clerck.*—Belfast; common.

Cirrhœdia xerampelina, *Hb.*—Belfast, Castlewellan.

Calymnia trapezina, *L.*—Ballycastle, Glenarm.

Dianthœcia capsophila, *Dup.*—Ballycastle, Rathlin Island, Copeland Islands.

Dasypolia Templi, *Thnb.*—Glenarm.

Aporophyla nigra, *Haw.*—Ballycastle.

Hadena contigua, *Vill.*—Mourne mountains; scarce.

Anarta myrtilli, *L.*—Mourne mountains; common.

Calocampa exoleta, *L.*—Ballycastle, Belfast; common.

Phytometra viridaria, *Clerck.*—Belfast hills, Slieve Donard.

Ellopia prosopiaria, *L.*—Donard Demesne near Newcastle.

Crocallis elinguaria, *L.*—Loughbrickland.

Nyssia zonaria, *Schiff.*—Ballycastle; very abundant.

Geometra papilionaria, *L.*—Loughbrickland.

Vernusia cambrica, *Curt.*—Donard Demesne; scarce.

Acidalia marginepunctata, *Göze.*—Kilkeel; scarce.

Scodiona belgiaria, *Hb.*—Mourne mountains.

Hybernia aurantiaria, *Bork.*—Clough, Co. Antrim.

H. defoliaria, *Clerck*, *L.*—Ballycastle, Glenarm.

Oporabia filigrammaria, *H. S.*—Belfast hills.

O. autumnaria, *Gn.*—Belfast hills.

Larentia multistrigaria, *Haw.*—Ballycastle, Belfast hills.

L. cæsiata, *Lang.*—Divis Mountain and Belfast hills, abundant; but scarce on the Mourne mountains.

L. salicata, *Hb.*—Ballycastle, Larne, Cave Hill.

Emmelesia alchemillata, *L.*—Ballycastle, Bryansford.

E. decolorata, *Hb.*—Belvoir Park, Belfast, abundant; fairly common on Ballygally Head, near Larne, and along the coast in sheltered spots wherever the Red Campion grows.

E. tæniata, *St.*—Belvoir Park, Belfast; Donard Demesne.

E. minorata, *Tr.*—Mourne mountains.

Eupithecia indigata, *Hb.*—Belfast.

E constrictata, *Gn.*—Island Magee, common; Kilkeel.

E. lariciata, *Frr.*—Larne, Colin Glen, Donard Demesne.

E. abbreviata, *St.*—Ballycastle.

E. sobrinata, *Haw.*—Belfast, Slieve Donard; scarce.

E. pumilata, *Hb.*—Mourne mountains.

Thera firmata, *Hb.*—Donard Demesne; scarce.

Hypsipetes trifasciata, *Bork.*—Colin Glen; very abundant.

Melanthia bicolorata, *Hufn.*—Glenarm, Colin Glen.

M. albicillata, *L.*—Donard Demesne.

Anticlea nigrofasciaria, *Göze.*—Colin Glen; scarce.

Coremia munitata, *Hb.*—Slieve Croob, Co. Down; scarce.

Phibalapteryx lapidata, *Hb.*—Divis Mountain; five specimens taken in a reedy spot on September 3rd.

Scoparia ingratella, *Zell.*—Knockagh near Carrickfergus.

S. truncicolella, *Sta.*—Donard Demesne.

Scopula ferrugalis, *Hb.*—Island Magee; scarce.

Platyptilia ochrodactyla, *Hb.*—Dunnaneile Island in Strangford Lough.

P. isodactyla, *Zell.*—Marshy ground between Divis and Black mountains.

Amblyptilia acanthodactyla, *Hb.*—Belfast, Newcastle; scarce.

Mimœseoptilus pterodactylus, *Hb.*—Black Mountain.

Aciptilia tetradactyla, *L.*—Island Magee; scarce.

Crambus pinellus, *L.*—Belfast.

C. selasellus, *Hb.*—Belfast.

C. geniculeus, *Haw.*—Newcastle, Rostrevor Mountain.

Homœosoma senecionis, *Vaughan.*—Newcastle, scarce; Happy Valley and Bloody Bridge Valley.

Phycis fusca, *Haw.*—In Mourne mountains.

P. subornatella, *Dup.*—Island Magee; rare.

Tortrix unifasciana, *Dup.*—Belfast hills; common.

T. palleana, *Hb.*—Black Hill; common.

Peronea Schalleriana, *L.*—Island Magee.

P. hastiana, *L.*—Belfast; scarce.

P. caledoniana, *St.*—Belfast hills; common.

Penthina betulætana, *Haw.*—Holywood.

Mixodia Schulziana, *Fb.*—Belfast hills, Mourne mountains.

Sciaphila conspersana, *Dougl.*—Portrush, Belfast.

S. hybridana, *Hb.*—Killough.

Sphaleroptera ictericana, *Haw.*—Belfast; scarce.

Phoxopteryx myrtillana, *Tr.*—Belfast hills; scarce.

Grapholitha nigromaculana, *Haw.*—Mourne mountains.

G. trimaculana, *Dou.*—Belfast.

Hypermecia cruciana, *L.*—Portrush.

Olindia ulmana, *Hb.*—Donard Demesne near Newcastle.

Pamplusia mercuriana, *Hb.*—On the summit of Slieve Bingian, 2,400 feet.

Stigmonota perlepidana, *Haw.*—Colin Glen; abundant.

Dicrorampha plumbana, *Scop.*—Knockagh; abundant.

D. herbosana, *Bar.*—Belfast hills, Cave Hill.

Catoptria hypericana, *Hb.*—Belfast hills.

Choreutes myllerana, *Fb.*—Holywood.

Argyrolepia Hartmanniana, *Clerck.*—Belfast hills; local.

Conchylis straminea, *Haw.*—Island Magee.

Aphelia osseana, *Scop.*—Portrush, Belfast; common.

Ochsenheimeria birdella.—Belfast, Holywood.

Lampronia luzella, *Hb.*—Belfast; scarce.

L. rubiella, *Bjerk.*—Holywood.

Hyponomeuta cagnagellus, *Hb.*—Holywood, Loughbrickland.

Orthotelia sparganella, *Thnb.*—River Lagan near Belfast.

Depressaria umbellana, *St.*—Newcastle; scarce.

Bryotropha terrella, *Hb.*—Belfast.

B. desertella, *Dougl.*—Newcastle sand-hills.

B. politella, *Dougl.*—Belfast.

Lita artemisiella, *Tr.*—Newcastle sand-hills.

L. marmorea, *Haw.*—Newcastle, very abundant in sand-hills.

Teleia dodecella, *L.*—Belfast hills; scarce.

Glyphipteryx Haworthana, *St.*—Belfast; scarce.

G. equitella, *Scop.*—Island Magee; abundant.

Argyresthia ephippella, *Fb.*—Belfast.

A. mendica, *Haw.*—Montalto Demesne, Ballynahinch.

Gracilaria tringipenella, *Zell.*—Island Magee; scarce.

Coriscum sulphurellum, *Haw.*—Colin Glen.

Elachista monticola, *Wk.*—Ballynahinch.

Lyonetia Clerckella, *L.*—Holywood.

W. F. J.

COLEOPTERA.

In this order some good work has been done by both past and present workers, with the result that I am able to record several rare and interesting species.

That vast sheet of water, Lough Neagh, has long been celebrated as the home of many rarities in natural history. To the coleopterist its shores offer a most tempting hunting-ground, nor will a visit be likely to be unrewarded. Here are to be found such rarities as *Dyschirius obscurus*, *Pelophila borealis*, *Bembidium argenteolum*, *Stenus palposus*, and *Silpha dispar*. I must warn my brethren of the net, however, that these species require to be looked for at the proper time of year, else disappointment will ensue. The months of May and June are the most likely time for capturing these species, though *Pelophila* and *S. dispar* may be obtained in July.

The Mourne mountains can hardly be said to have been searched at all, but the success of G. C. Champion's visit to them should encourage further search. The capture of such good things as *Oxypoda rupicola*, *Ocyusa hibernica*, *Homalota alpestris*, and *H. eremita* seems to indicate the probability of other equally pleasing captures.

The Longicornia are not at all well represented in Ireland, but at Tollymore Park more than one species of these beetles has been met with. The shores of Strangford Lough seem to be peculiarly attractive to the genus *Heterocerus*, three species at least having occurred there. The coast sand-hills at Newcastle, Portrush, and Portballintrae have proved very productive of beetles, and several interesting species are to be found there. The hills round Belfast are capital collecting-grounds, and even Rathlin Island is not without attractions for the collector.

I have not attempted to give a full list of all the beetles occurring in the district, as space would not admit of it, and the information can be obtained from the *List of the Beetles of Ireland*, just published by J. N. Halbert and myself. I have instead selected the more rare and interesting species, giving the localities of their capture, and such notes as I thought likely to be of interest.

The British list of Coleoptera contains some 3,300 species. In round numbers, the Irish list extends to 1,600 species, or rather less than half of the total of the British list; of these, about 750 species have been met with in Antrim and Down. The cause of the small numbers in the Irish list and in that for these two counties is the same; viz., want of workers.

Carabus glabratus, *Payk.*—Near Belfast, Slieve Donard.

C. violaceus, *L.*—Rathlin Island.

C. clathratus, *L.*—Rathlin Island, Clough and Cranmore, Co. Antrim; Birkie Bog, Co. Down.

C. nitens, *L.*—Glenarm, Birkie Bog.[1]

Pelophila borealis, *Payk.*—Shores of Lough Neagh at Shane's Castle, Toome, and on Ram's Island. It should be looked for under stones on firm mud.

Blethisa multipunctata, *L.*—Clough; near Belfast; the latter locality probably refers to the shore of Lough Neagh.

Clivina collaris, *Herbst.*—Ballycastle, Co. Antrim.

Dyschirius obscurus, *Gyll.*—Taken by Haliday on the shore of Lough Neagh, probably at Shane's Castle. It burrows in sand like others of the genus, and has been found in company with *Bledius subterraneus* at Maghery and Ardmore on the Armagh side of the lake. There is no other known locality for it in the British Isles.

D. salinus, *Schaum.*—On the northern bank of the river between Comber and Strangford Lough, about a quarter of a mile from latter.

Bradycellus harpalinus, *Dej.*—Portballintrae.

Harpalus puncticollis, *Payk.*—Whitepark, County Antrim.

H. tardus, *Panz.*—Newcastle, Co. Down.

Pterostichus oblongo-punctatus, *F.*—Whitepark Bay, Murlough Bay, Ballycastle.

P. vitreus, *Dej.*—Rathlin Island, Cave Hill.

[1] Birkie Bog has now disappeared, but as well as can be ascertained it was situated in the barony of Lower Castlereagh, between Moneyreagh and Comber.

P. minor, *Gyll.*—Portrush, Holywood.

Amara consularis, *Duft.*—Rathlin Island, Groomsport.

A. plebeia, *Gyll.*—Rathlin Island, Dunluce, Strandtown.

Calathus melanocephalus, *L.*, var. **nubigena**, *Hal.*—Carrickfergus, Cave Hill, Slieve Donard.

Sphodrus leucophthalmus, *L.*—Island Magee; there is no recent record of its occurrence in this district.

Anchomenus gracilis, *Gyll.*—Ballycastle.

Cillenus lateralis, *Sam.*—Strangford Lough, Dundrum Bay.

Bembidium Clarki, *Daws.*—Ram's Island.

B. doris, *Panz.*—Toome.

B. nitidulum, *Marsh.*—Cave Hill, in disused limestone quarry.

B. lunatum, *Duft.*—Rathlin Island, lake shore.

B. flammulatum, *Clairv.*—Rathlin Island, banks of Lagan Canal, Newtownbreda.

B. argenteolum, *Ahr.*—Specimens of this interesting addition to the British list of Coleoptera were found in the collection of the late Robert Patterson, F.R.S., labelled as *B. paludosum*, Panz.; they were taken on the shore of Lough Neagh at Shane's Castle by Mr. Patterson, as recorded in his book, *Insects mentioned in Shakespeare*, London, 1838. The record in Dawson's *Geodephaga Britannica* of the capture of *B. paludosum* at Lough Neagh refers to Mr. Patterson's capture, as also does Mr. Haliday's in his Belfast list. It has been taken at Glenavy by H. L. Orr recently.

Aëpus marinus, *Ström.*—Strangford Lough.

Trechus lapidosus, *Daws.*—Holywood.

Patrobus excavatus, *Payk.*—Cave Hill, Glengormley.

P. assimilis, *Chaud.*—Rathlin, Cave Hill, Newcastle, Rostrevor Mountain.

Dromius nigriventris, *Thoms.*—Portballintrae, near Belfast.

Noterus clavicornis, *De G.*—Glenavy, Portmore Lough, Lagan Canal.

N. sparsus, *Marsh.*—Lagan Canal, Strandtown.

Cœlambus versicolor, *Schall.*—Recorded by Haliday, from the vicinity of Belfast, under the name of *Hygrotus reticulatus*. It has, however, not been met with since his time, and it is not improbable that there was some confusion with the following species.

C. quinquelineatus, *Zett.*—Lagan Canal, Ballynahinch, Strandtown. Quite a common species in Ulster.

C. confluens, *F.*—Recorded by Haliday from the neighbourhood of Belfast.

C. novemlineatus, *Steph.*—Toome.

Hydroporus rivalis, *Gyll.*—Lagan Canal.

H. vittula, *Er.*—Holywood, swamp near Lagan Canal.

Agabus unguicularis, *Thoms.*—Bog Meadows, Lagan Canal, Downpatrick.

Orechtochilus villosus, *Müll.*—Bangor, Co. Down.

Enochrus bicolor, *Gyll.*—Loughbrickland. on shore of lake.

Helophorus rugosus, *Ol.*—Portrush, Portballintrae, on the sand-hills near the River Bush.

H. nubilus, *F.*—Near Belfast.

Octhebius punctatus, *Steph.*—Shore of Belfast Lough.

Cercyon hæmorrhous, *Gyll.*—Glengormley.

C. aquaticus, *Muls.*—Cave Hill.

Aleochara grisea, *Kr.*
A. algarum, *Faur.* } Craigavad, among seaweed.

A. obscurella, *Kr.*—Ballycastle, Newcastle.

Oxypoda alternans, *Grav.*—Ballycastle; in fungi on the bank of the Lagan Canal near Belfast.

O. rupicola, *Rye.*—On the summit of Slieve Donard, under stones.

Ocyusa incrassata, *Kr.*—Lagan Canal, Holywood.

O. hibernica, *Rye.*—In moss on the top of Slieve Donard.

Ocalea castanea, *Er.*—Ballycastle.

Ilyobates nigricollis, *Payk.*—Cave Hill.

Callicerus obscurus, *Grav.*—"Taken at Holywood in the shelter of furze bushes; in the first burst of spring I

have found it abundant on the fresh grass of sunny banks." —A. H. Haliday, *Brit. Ent.*

Homalota alpestris, *Heer.*
H. eremita, *Rye.*
H. valida, *Kr.*
} These three species have been met with on Slieve Donard.

H. nigra, *Kr.*—Craigavad, Holywood.

H. laticollis, *Steph.*—Ballycastle, Co. Antrim.

H. orbata, *Er.*—Newcastle.

Leptusa fumida, *Er.*—Under bark of sycamore tree in Carr's Glen.

Phytosus spinifer, *Curt.*—Newcastle.

Myllena brevicornis, *Matth.*—Carr's Glen.

Gymnusa variegata, *Kies.*—Taken by A. H. Haliday at Holywood.

Mycetoporus angularis, *Rey.*—Cave Hill.

Heterothops binotata, *Er.*—Greencastle, Co. Down, on the beach.

Quedius puncticollis, *Thom.*—Hanging Wood near Ballycastle.

Q. cruentus, *Ol.*—Murlough Bay.

Q. umbrinus, *Er.*—Ballycastle.

Leistotrophus nebulosus, *F.*—Cushendun.

L. murinus, *L.*—Newcastle.

Ocypus brunnipes, *F.*—Cave Hill, Holywood.

Philonthus carbonarius, *Gyll.*—Ballintoy.

Cafius sericeus, *Holme.*—Strangford Lough.

Xantholinus tricolor, *F.*—Greencastle, in seaweed on the beach.

Lathrobrium quadratum, *Payk.*—Ram's Island.

L. terminatum, *Grav.*—Belvoir Park.

Stilicus orbiculatus, *Er.*—Ballycastle.

Pæderus fuscipes, *Curt.*—Ram's Island; taken in numbers in moss close to the water.

Dianous cœrulescens, *Gyll.*—Mountain streams in County Antrim.

Stenus buphthalmus, *Grav.*—Lagan Canal near Moira.

S. pusillus, *Er.*—Whitepark, Co. Antrim.

S. geniculatus, *Grav.*—Slieve Donard.

Oxytelus sculpturatus, *Grav.*—Ballycastle.

Ancyrophorus omalinus, *Er.*—Cave Hill.

Lesteva sicula, *Er.*—Newcastle.

Acidota crenata, *F.*—Lagan Canal, Newcastle on the sand-hills.

Arpedium brachypterum, *Grav.*—Slieve Donard.

Micralymma brevipenne, *Gyll.*—Strangford Lough.

Omalium vile, *Er.*—Under bark in Carr's Glen.

Eusphalerum primulæ, *Steph.*—Bangor.

Pseudopsis sulcata, *Newm.*—Holywood, shore of Lough Neagh. Specimens of this rare beetle are extant in the collection of the late Robert Patterson, F.R.S., which were taken by Mr. Haliday at Lough Neagh.

Silpha nigrita, *Creutz.*—Rathlin Island.

S. dispar, *Herbst.*—On the shore of Lough Neagh near Shane's Castle.

Hister neglectus, *Germ.*—Mourne mountains. This species is much more common than *H. carbonarius*.

Saprinus quadristriatus, *Hoff.*—Portballintrae, Ballycastle.

Onthophilus striatus, *F.*—Cushendun, Glenavy.

Trichopteryx atomaria, *De G.*
T. brevipennis, *Er.*
} Both these species were taken at Holywood in moss.

Ptenidium evanescens, *Marsh.*—Ballycastle, Holywood.

Subcoccinella xxiv.-punctata, *L.*—Whitehead.

Adalia obliterata, *L.*—Portballintrae.

Micropeplus porcatus, *Payk.*—Glengormley, Templepatrick, Comber, Holywood Hill.

M. margaritæ, *Duv.*—Bangor.

M. tesserula, *Curt.*—In a marsh near Holywood.

Epuræa æstiva, *L.*—Portballintrae, Hanging Wood near Ballycastle, Bangor.

E. deleta, *Er.*—Comber.

Soronia grisea, *L.*—Cranmore, Co. Antrim.

Omosita colon, *L.*—Ballyhoman near Ardglass, Co. Down.

Cychramus fungicola, *Heer.*—Tollymore Park and Rostrevor.

Cerylon histeroides, *F.*—Belvoir Park.

Rhizophagus perforatus, *Er.*—Ballynahinch.

R. dispar, *Gyll.*—Newcastle.

Corticaria denticulata, *Gyll.*—Bank of Lagan Canal near Lisburn.

C. umbilicata, *Beck.*—Portballintrae, Whitehead.

Antherophagus nigricornis, *F.*—Near Kenbane Head, Co. Antrim.

Atomaria berolinensis, *Kr.*—Whitehead, in tufts of grass.

Parnus auriculatus, *Panz.*—Among refuse on the shore of Lough Neagh near Antrim.

Heterocerus flexuosus, *Steph.*
H. arenarius, *Kies.*
} These two species were taken on the shore of Strangford Lough, near Newtownards.

H. britannicus, *Kuw.*—About high-water mark on the river bank between Comber and Strangford Lough.

Aphodius putridus, *Sturm.*—Cushendun, Slieve Donard.

Geotrupes typhœus, *L.*—On the sand-hills at Newcastle.

G. vernalis, *L.*—Portrush on the sand-hills, Ballintoy.

Cetonia aurata, *L.*—A specimen in the Museum of the Belfast Natural History and Philosophical Society, labelled "Whitehouse." It has not been met with recently.

Athous niger, *L.*—Strandtown, Tollymore Park.

Hydrocyphon deflexicollis, *Mull.*—Newcastle.

Podabrus alpinus, *Payk.*—Tollymore Park, Rostrevor.

Malthodes flavoguttatus, *Kies.*
M. pellucidus, *Kies.*
} Carr's Glen.

Clytus arietis, *L.*—Cranmore.

Rhagium inquisitor, *F.*—Tollymore Park.

R. bifasciatum, *F.*—Newcastle.

Grammoptera ruficornis.—Shane's Castle, Tollymore Park.

Acanthocinus ædilis, *L.*—Taken by a workman on the Queen's Island, Belfast.

Monochammus confusor, *Kirby.*—A specimen of this American species was taken in a garden near Belfast,

whither it had been conveyed in timber that had formed a ship's dunnage.

Donacia dentipes, *F.*—Newcastle.

D. bicolora, *Zsch.*—Lagan Canal near Moira.

Lema septentrionis, *Weise.*—Ballycastle, Bangor.

Timarcha violaceonigra, *De G.*—Colin Glen, Co. Antrim.

Chrysomela varians, *Schall.*—Rathlin.

Phytodecta pallida, *L.*—Rostrevor.

Lochmæa capreæ, *L.*—Newcastle.

Longitarsus ater, *F.*—Portstewart. In 1827 this beetle destroyed the flax crop in Co. Down. Vide *Insects in Shakespeare*, by R. Patterson, F.R.S.

Mniophila muscorum, *Koch.*—Colin Glen; Rostrevor.

Crepidodera aurata, *Marsh.*—Portmore, Co. Antrim.

Chætocnema hortensis, *Fourc.*—Kenbane Head.

Psylliodes chrysocephala, *L.* — Portballintrae, Strandtown: var. **anglica**, *F.*—Portballintrae.

Heliopathes gibbus, *F.*—Downpatrick, Ballyhoman near Ardglass, Newcastle.

Tenebrio molitor, *L.*—Belfast, in timber yard.

T. obscurus, *F.*—Specimen in College Square Museum, labelled "In dry flour, Comber mills, near Belfast, 1860, beetle appeared in August."

Helops pallidus, *Curtis.*—Portballintrae; at roots of grass on the sand-hills at Bush Bay.

Salpingus æratus, *Müll.*—Cave Hill.

Anaspis rufilabris, *Gyll.* — Shane's Castle, Lagan Canal near Lisburn.

A. subtestacea, *Steph.*—Cullybackey, Co. Antrim.

Meloë proscarabæus, *L.*
M. violaceus, *Marsh.*
} Holywood. There are no recent records of the occurrence of these insects in this locality.

Apion cruentatum, *Walton.*—Portrush, Ballyhoman.

A. hæmatodes, *Kirby.*—Portballintrae.

Otiorrhynchus blandus, *Gyll.*—Dunluce, Kilkeel.

O. scabrosus, *Marsh.*—Portballintrae.

O. muscorum, *Bris.*—Kilroot, Co. Antrim; Newcastle.

Brachysomus echinatus, *Bonsel.*—Whitehead, Co. Antrim.

Tropiphorus tomentosus, *Marsh.* — Carrickfergus, Cave Hill.

Philopedon geminatus, *F.* — The large white form occurs at Ballintoy and Whitepark Bay.

Sitones cambricus, *Steph.*—Rostrevor.

Cleonus sulcirostris, *L.*—Tyrella sands near Dundrum, Co. Down.

Orchestes salicis, *L.*—Hanging Wood near Ballycastle.

Thryogenes festucæ, *Herbst.*—Lagan Canal.

Dorytomus tortrix, *L.*—Kilroot, Strandtown, Holywood.

Tanysphyrus lemnæ, *F.*
Bagous alismatis, *Marsh.* } Lagan Canal.

Miccotrogus picirostris, *F.*—Cushendun.

Anthonomus comari, *Crotch.*—Ballycastle.

Cœliodes cardui, *Herbst.*—Bangor, rarely by sweeping.

Ceuthorrhynchus pleurostigma, *Marsh.* — Portballintrae, Bangor.

C. rugulosus, *Herbst.*—Portballintrae, Bangor.

Phytobius quadrituberculatus, *F.* — Holywood, Bangor.

Rhopalomesites Tardyi, *Curt.* — Cranmore, Newcastle, Tollymore Park, Rostrevor Mountain.

W. F. J.

Hemiptera.

Comparatively little is known concerning the Hemiptera of the counties of Antrim and Down. This is not surprising considering the way in which the study of this order of insects has been neglected by entomologists. It is known that the late A. H. Haliday formed an extensive collection of Irish Hemiptera, which is now preserved in the Dublin Museum, and many of the species contained therein were, no doubt, collected in the vicinity of Belfast. But as Haliday's energies were more particularly directed to the study of other groups of insects, he left but few notes relating to the Hemiptera, and it is a matter for regret that the majority of the specimens in his collection have not been

specially localized. As an example may be mentioned the rare Pond-skater *Gerris rufoscutellata*, which has not been found in Ireland since Haliday's time, and may well have been a "local find." It is to be hoped that some one of the Belfast entomologists may be induced to take up the study of this group of insects, and in due time rediscover some of the indefinitely recorded Irish species. Perhaps the most interesting local Hemipteron as yet brought to light is the Water-bug, *Apelocheirus æstivalis*, an immature specimen of which was obtained a few years ago by R. Welch while dredging at Lough Neagh—that prolific hunting-ground of past and present Belfast naturalists. C. W. Buckle rediscovered this fine species during the summer of 1901, when he found may scores of dead specimens which had been cast up on the north-eastern shore at Sandy Bay. As Lough Neagh is the only known Irish locality for this insect, it is of interest to note that it has only been found in a few places in the midland and southern counties of England, while its continental range extends from France eastwards to Hungary. Another uncommon record is that of the Bat parasite *Cimex pipistrelli*. Specimens of this insect were obtained off bats captured near Toome by H. L. Orr in the month of June, 1900. It is a decidedly local species, recorded only from a few localities in the south of England, and seems rare on the continent of Europe. The Shield Bugs (*Pentatomina*) are scarce, generally, in the north of Ireland, but at least six species have been found in the counties of Antrim and Down. These are—*Piezodorus lituratus*[1] (locally plentiful on the flowers of Furze on the shore of Lough Neagh, also at Cushendun and near Portadown); *Tropicoris rufipes* (common); *Podisus luridus* (the larvæ of this species were obtained off trees in Tollymore Park by W. H. Patterson); *Acanthosoma hæmorrhoidale* (Ballinderry, on *Laurestinus*); *A. tristriatum* (taken by Haliday in Tollymore Park, the only locality in which it has hitherto been found in Ireland); *A. interstinctum* (Tollymore Park). The following species of Heteroptera may also be referred to; e.g., *Berytus minor* (Black Head, Co. Antrim); *Microvelia pygmæa* (this little

[1] The nomenclature is that of E. Saunders: *The Hemiptera Heteroptera of the British Islands.*

Water-bug was first taken in Britain by A. H. Haliday—in a marsh near Holywood—and a note in his diary records the capture of the rare winged form at "Castlehill Moss"); *Velia currens* (the so-called Water-spider is common, especially at Lough Neagh); *Gerris thoracica* (Cave Hill); *G. odontogaster* and *G. argentata* (both of these species occur in the Lagan Canal, the latter also at Newcastle); *Salda pallipes* (salt marshes near Belfast); *S. scotica* (Newcastle); *Cryptostemma alienum* (taken by *Haliday* in Antrim, exact locality not known); *Acompocoris pygmæus* (near Belfast); *Microphysa elegantula* (Carr's Glen); *Calocoris striatellus* (Broughshane); *C. sexguttatus* (near Belfast); *Pœciloscytus unifasciatus* (Lagan Canal bank, near Moira); *Campyloneura virgula* (Rostrevor); *Plagiognathus pulicarius* (Lough Neagh, being the only known Irish locality). The true Water-bugs (*Cryptocerata*) are better known locally than any other section of the Hemiptera. The following are a few of the less common kinds which have been taken in the district: *Corixa Geoffroyi* (Lagan); *C. atomaria* (Holywood); *C. limitata* (Newcastle); *C. venusta* (Holywood and Newcastle); *C. fossarum* (Lagan); *C. prœusta* (Lagan); *C. cognata*, Fieb. (Newcastle); and the local *C. Bonsdorffi* is not uncommon in the Lagan Canal near Belfast. The varieties *maculata* and *furcata* of the Water Boatman (*Nepa cinerea*) occur—the former at Lough Neagh, and the latter near Bangor. They are much rarer than the type, and are apparently absent from many parts of Britain. With the exception of a few extremely common kinds, nothing is known of the *Homopterous* section of the local Plant Bugs.

J. N. H.

Neuroptera.

No group of animals seems to have been more neglected by Ulster naturalists than the various orders of insects comprised under the order "Neuroptera." Mr. King's recent list of these insects[1] occurring in Ireland contains hardly any records from the north. Still a few interesting forms have

[1] J. J. F. X. King.—A Contribution towards a Catalogue of the Neuropterous Fauna of Ireland. *Trans. Nat. Hist. Soc. Glasgow*, vol. ii, 1888, pp. 259–292.

been found in the district. *Micronympha pumilio* for example, a southern dragonfly, very scarce in Great Britain, has occurred at Belfast and nowhere else in Ireland. The Caddis-fly, *Stenophylax concentricus*, together with other commoner species, has been taken at night, flitting around the Belfast street lamps. *Crunœcia irrorata* and *Berœa maurus* are among the more interesting Caddis-flies recorded from Colin Glen.

G. H. C.

Orthoptera.

A few of the commoner British Orthoptera are known to occur in the district, but the discovery in 1900 of a specimen of the Mole-cricket (*Curtilla gryllotalpa*) in an old buried canoe near Toome, at the northern end of Lough Neagh is most remarkable. No other Irish locality for this conspicuous species is known, and it is puzzling to find an insect so characteristically southern in Great Britain apparently indigenous in Ulster.

G. H. C.

Aptera.

This obscure but highly interesting group of insects, which, neglected for many years by entomologists, is now attracting a good deal of attention, found a pioneer student early in the last century in Robert Templeton of Belfast. His classical memoir,[1] in which three species of Thysanura and fourteen (in reality twelve) of Collembola are enumerated, was founded almost entirely on specimens procured in his own grounds at Cranmore, now included in the city of Belfast. It may be useful to note the species described by Templeton: they were—Thysanura: *Machilus maritima*, Lenb.; *M. polypoda* (Lina.); *Lepisma saccharina*, Lina. Collembola: *Smynthurus viridis* (L.); *S. fuscus* (L.), (= *atra*, Templ.); *Papirius minutus* (Fab.), (= *S. signata*, Templ.); *Orchesella cincta* (L.), (= *O. cincta* + *O. filicornis*

[1] R. Templeton.—Thysanuræ Hibernicæ, or descriptions of such species of Spring-tailed Insects (Podura and Lepisma, Lina.) as have been observed in Ireland, with Introductory Observations upon the Order by J. D. Westwood. *Trans. Ent. Soc.*, vol. i, 1834, pp. 89–98.

+ *Podura cingula*, Templ.); *Tomocerus tridentiferus*, Tullb. (= *Podura plumbea*, Templ.); *Heteromurus nitidus* (Templ.); *Entomobrya nivalis* (L.), (= *Podura nigromaculata*, Templ.); *E. albocincta* (Templ.); *Isotoma viridis*, Bourl. (= *P. fuliginosa*, Templ.); *I. palustris* (Müll)., (= *P. stagnorum*, Templ.); *Achorutes viaticus* (L.), (= *dubius*, Templ.); *Anoura muscorum* (Templ.). In recent years, *Tomocerus plumbeus* (L.), *Podura aquatica*, L., and *Papirius ornatus*, Lubb., have been found near Belfast. All of these are common and well-known insects, but there can be no doubt that diligent study of the Aptera in Ulster would be repaid by the discovery of many scarce species, and, in all probability, of some forms new to science.

G. H. C.

Arachnida.

Araneida. — It was a Belfast naturalist, Robert Templeton, who, in the early decades of the nineteenth century, was the first to attempt a systematic study of Irish Spiders. His MS. "History of the Irish Arachnida" was incorporated in Blackwall's well-known Ray Society Monograph,[1] and his collections were largely made in his own grounds of Cranmore, now included in the city of Belfast. The study of spiders in Ireland remained, after Templeton's death, neglected for many years, until another Belfast naturalist, Thomas Workman, whose recent lamented death is still mourned by his colleagues, began his laborious and fruitful researches into this group of Arachnids. He published in 1880 a list of 125 Irish species,[2] of which by far the greater number were obtained in the counties of Antrim and Down. Of the 225 Irish species that are enumerated in Carpenter's recent list,[3] 105 are recorded from those two counties, and 150 from the province of Ulster.

---

[1] J. Blackwall.—A History of the Spiders of Great Britain and Ireland. London (Ray Society), 1861–4.

[2] T. Workman.—A Contribution towards a List of Irish Spiders. *Entomologist*, vol. xiii, 1880, pp. 125–130. Irish Spiders. *Proc. Belfast Nat. Hist. and Phil. Soc.*, 1878–9 and 1879–80, pp. 267–282 and plate.

[3] G. H. Carpenter.—A List of the Spiders of Ireland. *Proc. R. Irish Acad.* (3), vol. v, 1898, pp. 128–210.

The relations between the ascertained Spider fauna of Ireland, of Ulster, and of Counties Antrim and Down, are shown roughly by the annexed table, though the relatively low figures in the second and third columns probably indicate the need of fresh researches rather than a markedly poor fauna.

Family.	Ireland.	Ulster.	Antrim and Down.
Atypidæ	1	0	0
Dysderidæ	4	4	4
Oonopidæ	1	1	1
Drassidæ	9	6	6
Clubionidæ	20	15	9
Sparassidæ	1	0	0
Thomisidæ	14	7	5
Agelenidæ	10	6	6
Dictynidæ	6	6	4
Pholcidæ	1	0	0
Theridiidæ	110	84	58
Tetragnathidæ ...	7	2	2
Argiopidæ	16	10	8
Lycosidæ	21	13	12
Attidæ	9	4	3
Totals ...	230	158	118

Some large and conspicuous species, which occur more or less plentifully in the south and west of Ireland, seem to be really absent from the Belfast district. *Atypus piceus*, *Micrommata virescens*, *Misumena vatia*, *Tegenaria hibernica* and *T. atrica*, *Agelena labyrinthica*, *Dolomedes fimbriatus*, and *Pisaura mirabilis* are good examples of these. Most of them, evidently belonging to the southern faunistic group, would not be expected to occur near Belfast. But it is especially surprising and noteworthy that a few spiders of undoubtedly southern—some probably of a "Lusitanian"—origin belong to the Down and Antrim fauna. *Dysdera crocota*, *Prosthesima Latreillei*, and *Theridion aulicum* are examples of these. The bright-red *Dysdera* and the jet-black *Prosthesima*—rare and local spiders in Great Britain—seem specially characteristic of Ireland, being widely spread and not uncommon over the whole country.

Among the local species which seem worthy of special mention in such a notice as this are—*Dysdera Cambridgei*, Thor. (Glenarm, etc., Co. Antrim), *D. crocota*, C. Koch (Kircubbin, Co. Down), *Oonops pulcher*, Templ. (Down and Antrim), *Prosthesima Latreillei*, Simon (Colin Glen, Co. Antrim ; Craigdarragh, Co. Down), *P. pusilla*, Koch (Portrush, Co. Antrim), *Drassodes troglodytes*, Koch (Portrush), *D. ferrugineus*, Blackw. (Belfast : this problematical spider awaits re-discovery), *Clubiona neglecta*, Cambr. (Island Magee, Co. Antrim), *C. diversa*, Cambr. (Colin Glen), *Micaria pulicaria*, Sund. (Island Magee and Colin Glen), *Agroeca proxima*, Cambr. (Portrush and Newcastle), *A. gracilipes*, Bl. (Newcastle), *Tibellus oblongus*, Walck. (Newcastle), *Oxyptila horticola*, Koch (Colin Glen), *O. trux*, Bl. (Belfast), *Cryphoeca sylvicola*, Koch (Colin Glen), *Argyroneta aquatica*, Cl. (Downpatrick and Mourne mountains), *Hahnia montana*, Bl. (Portrush), *H. elegans*, Bl. (Belfast), *Dictyna uncinata*, Thor. (near Belfast), *Ero furcata*, Vill. (Colin Glen), *Theridion varians*, Hahn, **T. simile*, Koch, and **T. aulicum*, Koch (near Belfast), *Euryopis hæmatostigma*, Bl. (Belfast : another of Templeton's problematical species), *Enoplognatha thoracica*, Hahn (Portrush), *Pholcomma gibbum*, Westr. (Colin Glen), *Tiso vagans*, Bl. (Portrush and Craigdarragh), *Diplocephalus permixtus*, Cambr. (Portavoe, Co. Down), *D. Beckii*, Cambr. (Belfast), *Entelecara erythropus*, Westr. (Belfast, Island Magee), **Styloctetor broccha*, L. Koch (summit of Slieve Donard), *Dicymbium nigrum*, Bl., *Walckenaëra acuminata*, Bl. (Belfast), *Dismodicus bifrons*, Bl. (Colin Glen and Island Magee), *Erigone promiscua*, Cambr. (Island Magee), *E. dentipalpis*, Wid. (Giant's Causeway), *E. longipalpis*, Sund. (Glastry and Craigdarragh, Co. Down,) *Tmeticus prudens*, Cambr. (summit of Slieve Donard), *T. Huthwaitii*, Cambr. (Ram's Island and Mourne mts.), **Bathyphantes parvulus*, Westr. (Island Magee), *B. nigrinus*, Westr. (Belfast), *B. variegatus*, Bl. (Colin Glen), *Lephthyphantes obscurus*, Bl. (Colin Glen), *Labulla thoracica*, Wid. (Colin Glen and Newcastle), *Stemonyphantes bucculentus*, Cl. (Rathmullan, Co. Down), **Bolyphantes subnigripes*, Cambr. (Windsor, Belfast), *Meta Menardii*, Latr. (Castlewellan, Co. Down), *Lycosa leopardus*,

Sund., and *Pardosa prativaga*, Koch (Ram's Island, Lough Neagh), *Heliophanus flavipes*, Hahn, and *H. cupreus*, Walck. (Portrush).

The five species marked with an asterisk are unknown elsewhere in Ireland, and of these *Bolyphantes subnigripes* has never been found anywhere else at all. *Styloctetor broccha*—one of the most interesting of the many alpine species that reward the labours of the naturalist among the Mourne mountains—has not yet been discovered in Great Britain, while on the Continent is known to occur only among the Tyrolese and Swiss mountains. The male of this tiny spider possesses a remarkable musical organ.[1]

Phalangidea.—Of the fourteen species of Harvestmen that are known to occur in Ireland, ten have been found within the Belfast district. These are *Liobunum rotundum*, Latr., *L. Blackwallii*, Meade, *Phalangium opilio*, Linn., *Platybunus corniger*, Herm., *Megabunus diadema*, Fab., *Mitopus morio*, Fab., *M. alpinus*, Herbst (Slieve Donard), *Acantholophus agrestis*, Meade, *A. tridens*, Koch, and *Nemastoma lugubre*, Müller. Several more species probably await discovery in the district, and *O. ephippiatus*, Koch, which has been taken in Co. Donegal, may certainly be expected to occur.

Chernetidea.—The only "false scorpions" that are yet known to inhabit the Belfast district are *Obisium muscorum*, Leach, and *Chthonius orthodactylus*, Leach.

Acarinida.—A few species of Water Mites *(Hydrachnidæ)* are known from the north-east. The following may be mentioned:—*Curvipes nodatus*, *C. rufus*, *Limnesia histrionica*, *L. maculata*, *L. Kœnikei*, *Lebertia* sp., *Hygrobates longipalpis*, and *Hydrachna scutata*. All of these are widely distributed forms, and occur in great abundance in Lough Neagh. Several interesting species have been detected in other of our northern lakes, and should be sought for in Lough Neagh, notably a new species—*Arrenurus Kanei*—recently described from Lough Erne: the nearest allied species inhabits Scandinavia.

G. H. C.

[1] G. H. CARPENTER.—The Smallest of Stridulating Spiders. *Natural Science*, vol. xii, 1898, pp. 319–322.

Pantopoda.

Pycnogonida.—No researches seem to have been made on this interesting group of marine arthropods in the Belfast district since Thompson,[1] in the last volume of his work, recorded, from the coasts of Down and Antrim, eight out of the nine species then believed to inhabit the Irish seas. Unfortunately three of these species—*Nymphon grossipes*, Linn., *N. Johnstoni*, Goodsir, and *N. femoratum*, Leach—are of uncertain value, though it is highly probable that some of the pycnogons referred to by these names belong to the form now known as *N. gallicum*, Hoek, which has a wide distribution around the Irish coasts as well as off the Isle of Man. The other species recorded from the district are *Nymphon gracile*, Leach, *Chætonymphon spinosum* (Goodsir), Belfast Bay, *Phoxichilidium femoratum* (Rathke), Strangford Lough, and *Pycnogonum littorale* (Stroem).[2]

G. H. C.

CRUSTACEA.

The Crustacea may be roughly classified into two great groups, one of which—the Entomostraca—contains almost all the minute forms, many of them parasitic; while the term Malacostraca is applied to all the larger and higher Crustacea.

Entomostraca.—Since Norman and Brady's Monograph of the British Cladocera appeared in 1867, very little has been published on Irish Phyllopods; but Creighton and W. F. de V. Kane[3] have recently devoted some attention to the freshwater forms, and the latter has recorded two northern species from Lough Neagh (viz., *Bythotrephes Cederstrœmi* and *Bosmina mixta*) which were not previously known from the British Islands. Among the commoner Lough Neagh Cladocera, formerly recorded by Haliday, may be mentioned *Eurycercus lamellatus*.

---

[1] W. Thompson.—*The Natural History of Ireland*, vol. iv. London, 1856 (p. 412).

[2] G. H. Carpenter.—On some Pycnogonida from the Irish Coasts. *Proc. R.D.S.*, vol. viii, 1893, pp. 195–205.

[3] W. F. de V. Kane.—Mysis relicta in Ireland. *Ann. and Mag. Nat. Hist.* (7th s.), vol. viii, 1901, pp. 391–397.

Belfast still remains the only locality in Ireland in which *Macrothrix laticornis* has occurred.

The Irish marine species of Ostracoda have been carefully worked out by Brady and Norman,[1] while the late Dr. Malcomson[2] has contributed an important paper on the Ostracoda of Belfast Lough.

Cypridopsis variegata and *Limnicythere sancti-patricii*—both rare in Ireland—have been discovered in Lough Neagh, while *Candona elongata* seems to be quite peculiar to it. The marine *Cythere cribrosa*, found by Malcomson at Rockport, Co. Down, in four fathoms of water, has never been taken living anywhere else, though it is known in the fossil state from the coast of Yorkshire.

Malcomson recorded also a number of very rare species which he dredged near the Maiden lighthouse, off the Antrim coast in deep water, among which we may mention *Cythere globulifera* and *C. cluthæ*, *Cytheridea subflavescens* and *Loxoconcha pusilla*. Among the species described by the same naturalist, there are two, one of which *(Bythocythere pavo)* has since been identified as the young of *B. recta*; the other (viz., *Paradoxoma truncatum*) is, according to Brady and Norman, identical with *P. Normani*.

The study of the Copepoda has been somewhat neglected in Ireland. We know that William Thompson took the parasitic *Argulus foliaceus* off a Salmon Trout at Belfast, and that the freshwater free-swimming forms, *Cyclops strenuus* and *Diaptomus gracilis*, occur in Lough Neagh, and *Cyclops æquoreus* near Belfast; but no list of the marine Copepoda of the north-east of Ireland has as yet been published.

The most noteworthy species, however, which have been taken on the Antrim and Down coasts are *Anomalocera Pattersoni*, *Ascidicola rosea*, *Notodelphys Allmani*, *Scolethrix hibernica*, *Caligus diaphanus*, *Caligus Mülleri* and *C. rapax* (occur also on the pollan in Lough Neagh), *Lepeoptheirus*

---

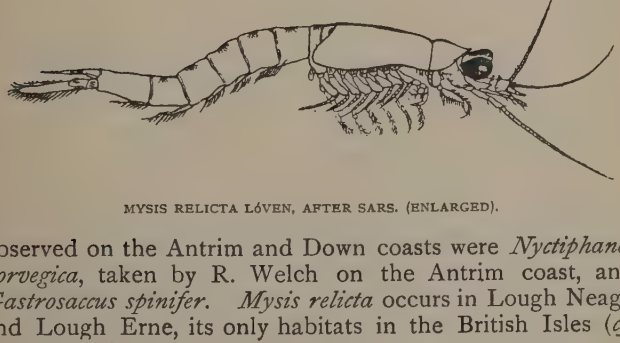
[1] G. S. Brady and A. M. Norman.—Monograph of the Marine and Freshwater Ostracoda of the North Atlantic and of North-Western Europe. *Trans. R. Dublin Soc.* (Sec. 2), vols. iv and v, 1889–1896.

[2] S. M. Malcomson.—Recent Ostracoda of Belfast Lough. *Proc. Belfast Naturalists' Field Club*, 1884–85.

Nordmanni, *Lernæopoda galei*, *Anchorella rugosa*, *Lernæa branchialis*.[1]

There have been no records of Cirripedia since the publication of William Thompson's *Natural History of Ireland*, vol. iv, according to whom *Lepas anatifera* and *L. fascicularis* have occurred on the Antrim coast, and *Scalpellum vulgare* in Belfast Lough. *Conchoderma virgata* and *C. aurita* seem to be occasionally imported into Belfast on the bottom of foreign vessels. Three or four species of *Balanus* and also *Chthamalus stellatus* have been taken near Belfast, while *Verruca strömia* has been found sometimes on wood floating in the bay.

Malacostraca.—In connection with the survey of the fishing-grounds of the west coast of Ireland, undertaken by the Royal Dublin Society, Holt and Beaumont published recently an excellent account of the Schizopod Crustacea of Ireland,[2] from which we gather that the most important species



MYSIS RELICTA LÖVEN, AFTER SARS. (ENLARGED).

observed on the Antrim and Down coasts were *Nyctiphanes norvegica*, taken by R. Welch on the Antrim coast, and *Gastrosaccus spinifer*. *Mysis relicta* occurs in Lough Neagh and Lough Erne, its only habitats in the British Isles (*cf. supra* Kane).

There has been no recent list of Irish Decapod Crusta-

[1] *Cf.* G. S. BRADY.—Monograph of British Copepoda, 3 vols., 1878–1880.

[2] E. W. L. HOLT and W. J. BEAUMONT.—Report on the Crustacea Schizopoda of Ireland. *Trans. R. Dublin Soc.* (s. 2), vol. vii, pp. 221–252, 1900.

ceans; but the late William Thompson of Belfast, aided by Templeton, Hyndman, and Drummond, made a splendid collection of the species living on the shores of the north-eastern counties, which is still preserved in the Museum of the Belfast Natural History and Philosophical Society.[1]

The Spider Crab *(Inachus scorpio)* appears to be common in Belfast Lough, while *I. dorynchus* and *I. leptochirus* are much rarer. *Eurynome aspera*, *Pirimela denticulata*, and *Xantho rivulosus* have not been taken in the lough, but occur on the northern coasts of Antrim. Specimens of the Great Crab *(Cancer pagurus)*, weighing 9 lbs., have been obtained from Belfast Lough. Of the genera of Crabs, *Carcinus*, *Platonychus* and *Portunus*, the only common species in Belfast Lough are *Carcinus mænas*, *Portunus puber*, *P. depurator*, and *P. pusillus*. The rare *Gonoplax angulata* has occurred once at Bangor, Co. Down, while three species of *Ebalia*, an *Atelecyclus*, and the only European species of *Corystes* have been occasionally taken near Belfast.

As regards the Hermit Crabs, the neighbourhood of Belfast seems to be particularly rich in them, and the late W. Thompson discovered no less than five species new to science, three of which (viz., *Eupagurus ulidianus*, *E. Hyndmanni*, and *E. lævis*) were described by himself from specimens obtained at Portaferry, Co. Down. Two others (viz., *Eupagurus cuanensis* and *E. Thompsoni*) were dredged in Belfast Lough, the latter species being named after its discoverer by Thomas Bell.

Most of the species of *Porcellana* and *Galathea* are common in the district, except *G. nexa*, which has only been obtained from the stomach of a Cod. The rare *Munida rugosa*, *Gebia deltura*, and *Callianassa subterranea* have only been taken in this manner.

The Freshwater Crayfish *(Astacus fluviatilis)*, so much appreciated as a culinary delicacy by our continental neighbours, is little esteemed in Ireland, and, indeed, few people know even of its existence, although it is common within ten miles of Belfast, in the small stream which enters Lough Neagh at Antrim, and known as the "Six-mile Water."

[1] W. Thompson.—The Crustacea Decapoda of Ireland. *Annals Nat. Hist.*, vols. x and xi, 1842–1843.

Lobsters *(Homarus vulgaris)* occur in Belfast Lough, but the so-called Norway Lobster *(Nephrops norvegicus)* frequents only the deeper waters off the County Down coast.

Of the Shrimp tribe, *Crangon vulgaris*—the Common Shrimp—is abundant in Belfast Lough. *C. fasciatus*, *C. sculptus*, *C. Allmani*, *C. Pattersoni*, and *Pandalus annulicornis* have all been taken in this locality, or just outside the Lough. *Hippolyte Thompsoni*, which was named after Thompson by Thomas Bell, has only been dredged off the north-west coast of Ireland. The so-called Common Prawn *(Palæmon serratus)* appears to be rare, as is also *P. varians*; only the small *P. squilla* is at all abundant.[1]

The only member of the Cumacea recorded from the north-east of Ireland is *Iphinoë trispinosa*, which is rarely taken in Strangford Lough.

A most useful revision of the Amphipoda of the British Isles is at present being published by the Rev. Canon Norman,[2] who has made a special study of the Crustacea. He himself has used the dredge extensively round the Irish coasts, and has given us many valuable records of the species frequenting the Irish seas, especially those of the west coast.

To seaside visitors, the Common Sandhopper *(Talictrus locusta)* is a familiar object, and it may serve as a type of an Amphipod. Most of the other members are rare on the Irish coast. *Orchestia Deshayesi*, *Lysianassa costæ*, *Iphimedea obesa*, *Melita palmata*, *Byblis Gaimardi*, and *Paramphithoë bicuspis* are all small forms which have occasionally been met with in Belfast Lough. *Lysianassa atlantica* and *Amphithoë rubricata* have only been found in Strangford Lough. Two species (viz., *Gammarus marinus* and *G. campylops*) occur in Lough Neagh and in the River Lagan. Among other rare Amphipods occurring in the Belfast Lough might be mentioned *Hyperia galba*, and the Skeleton Shrimp *Caprella acanthifera*.

The concluding group—Isopoda—contains Crustacea resembling the Common Woodlouse. The latter may be

[1] J. R. Kinahan.—On the Britannic Species of Crangon and Galathea. *Trans. R. Irish Acad.*, vol. xxiv. (Science), 1861.

[2] A. M. Norman.—British Amphipoda. *Ann. and Mag. Nat. Hist.*, vols. v, etc. (7th s.), 1900, etc.

taken as a typical representative of the Isopoda, except that its respiratory organs have been so modified from the usual form as to enable it to breathe on land, while most of the members of the group are confined to the sea. Many of the species are external parasites. *Idotea balthica* and *I. pelagica* have both been taken in Belfast Lough; while two other species (viz., *I. emarginata* and *I. linearis*) occur on the open coast of the County Down. The much-dreaded Gribble (*Limnoria lignorum*), which burrows into wooden piers, and is one of the most destructive Arthropods known, has also been noticed in Belfast Lough. No less than four species of *Sphæroma* have been observed in the same locality, and one of them (*S. serratum*) has migrated up the River Lagan to a considerable distance. The freshwater *Asellus aquaticus* is found not only in Lough Neagh but in almost every ditch in the district. *Gnathia maxillaris* has been taken off Bangor, Co. Down and *Athelges paguri* in Strangford Lough. *Eurydice pulchra* occurs in small rock-pools at Carrickfergus: whereas *Cirolana borealis* has been taken off the halibut in Belfast Lough. Among other species which have occurred in the Lough may be mentioned *Nesa bidentata*, *Cymodoce truncata*, and *C. emarginata*.

As for the terrestrial species of Isopods (the so-called woodlice), we find a number of records for the two counties in a paper recently published in the *Irish Naturalist*.[1] *Ligia oceanica* abounds all round the coast; while R. Welch has taken *Trichoniscus pusillus* in Co. Antrim and the very rare *T. roseus* at Ballyfinder, Co. Down. Of the genus *Porcellio*, only *P. scaber* is common; but *P. dilatatus* has also recently been discovered in a Belfast cellar by Mr. Buckle. *Oniscus asellus* and *Philoscia muscorum* are common all over the district. R. F. S.

GEPHYREA.

In W. Thompson's time the Gephyrean worms, which are all marine, were still looked upon as an order of the Echinoderms, but they are much more closely related to the Chætopods, though they include a somewhat heterogeneous assembly of worm-like creatures.

[1] R. F. Scharff.—The Irish Woodlice. *Irish Naturalist*, vol. iii, 1894.

Priapulus caudatus was obtained near Larne, where it burrows in sand. *Thalassema neptuni* is recorded by Templeton from the north of Ireland, and *Phascolosoma vulgare* was dredged in Strangford Lough by Hyndman.

R. F. S.

CHÆTOPODA.

This division includes the great mass of the worms which we commonly meet with, and which live in the ground, in fresh water, and also in the sea. Their body is made up of a series of segments mostly similar to one another, and provided at their sides with processes bearing bristles, which do duty as limbs. We can distinguish three great sections; viz., Polychæta, Oligochæta, and Hirudinea.

Polychæta.—All the Polychæt worms are marine. Their limb-like processes referred to are highly developed and bear many long bristles, and there is often a well-marked head with eyes and tentacles. Some of them are carnivorous and lead an active life, others are vegetable feeders and spend their existence in tubes, which they construct for themselves.

The small band of enthusiastic marine zoologists so often alluded to in these pages, whose headquarters were in Belfast, collected a great many species of these worms, both on the shore and in deep water, and sent them for determination to Dr. George Johnston, who published some interesting papers[1] on these collections. Unfortunately he died before he had time to complete his investigations, so that we only possess very fragmentary information on the Polychæt fauna of the district. Professor W. C. M'Intosh is now bringing out a monograph of the Polychæta of the British Islands, but only one volume has been issued so far. He has also published a note in the *Scientific Proceedings* of the Royal Dublin Society in 1896, on a few of the Irish Annelids preserved in the Dublin Museum. *Spinther oniscoides*, an American species allied to our sea-hare, has only been met

[1] G. JOHNSTON.—Contributions towards a History of the Irish Annelids. *Annals of Nat. Hist.*, vol. v, 1840.

with once in the British Islands. It was dredged in 1844 by Hyndman, off Castle Chichester, in Belfast Lough.

Oligochæta.—This section includes the Earth Worms and their allies, which have been specially studied by the Rev. H. Friend. Since the Royal Irish Academy appointed a committee to prepare reports on the various classes of Irish Vertebrates and Invertebrates, many of the more neglected groups have been investigated by specialists. The Oligochæts were allotted to Mr. Friend, but he has not had an opportunity of devoting his attention to the north-eastern parts of Ireland.

Hirudinea.—The Leeches have been studied by W. Thompson and Templeton in former years. More recently Scharff has published a revision of the Irish Freshwater Leeches, in which their number is reduced from eleven to eight.[1]

Piscocola percæ, a leech parasitic on some of the fresh-water fishes, is recorded by Templeton from the district. *Helobdella stagnalis*, *Glossiphonia heteroclita*, *G. complanata*, *Hemiclepsis tessellata*, and *Herpobdella octoculata* have all been taken in Lough Neagh. The Medicinal Leech appears to be absent from Ireland, but the Horse Leech *(Hæmopis sanguisuga)* is common throughout the country.

R. F. S.

BRACHIOPODA.

The Brachiopoda, whose external coverings are known as "Lamp-shells," are very well represented on the north-east coast of Ireland. Of about half a dozen Irish species no less than four have been taken in the district, and are referred to by Mr. Praeger in his paper[2] on the Marine Shells of the North of Ireland. *Terebratula caput-serpentis* and *Crania anomala* have been taken in deep water at the entrance of Belfast Lough, and Mr. Hyndman secured *Argiope cistellula* and the rare *A. capsula* on the Turbot Bank, a little further east than the preceding.

R. F. S.

[1] R. F. Scharff.—The Irish Freshwater Leeches. *Irish Naturalist*, vol. vii, 1898.

[2] R. Ll. Praeger.—The Marine Shells of the North of Ireland. *Proc. Belfast Nat. Field Club*, vol. ii (N.S.), 1887–88.

POLYZOA.

The "Sea-mats," as they are sometimes called, have been well looked after by Belfast naturalists. William Thompson, Hyndman, Allman, Templeton, Swanston and others, have all contributed to our knowledge of this interesting group, and we find their records mentioned in Hincks's work.[1] Of the rarer species which have been met off the coasts of our district might be mentioned *Caberea Ellisii*, *Flustra carbasea*, *Membranipora flustroides*, *M. imbellis*, *Cribrilina figularis*, *Schizotheca divisa*, *Porella minuta*, *Phylactella labrosa* and *P. eximia*, *Mucronella laqueata*, *Cellepora armata*, and *Stomatopora Johnstoni*.

Quite recently Miss Thornely has added to our knowledge of the Polyzoa of the Antrim coast by publishing a short account of some material dredged by R. Welch.[2]

R. F. S.

ROTIFERA.

No list of the "Wheel Animalcules" of the north-east of Ireland has ever been published, and in the two most recent Irish papers dealing with this group, by Miss Glascott and Mr. Hood, the counties of Down and Antrim have, unfortunately, been entirely neglected, so that there is yet a great field here for some members of the Belfast Naturalists' Field Club, who, no doubt, will take up the subject before long. R. F. S.

NEMATODA.

This group includes the "Round Worms," many of which are internal parasites, others being abundant in fresh and salt water. No one as yet has been sufficiently attracted towards these worms in north-eastern Ireland to make a special study of them, and even Thompson's records are meagre in the extreme. Indeed the only one he refers to is *Gordius aquaticus*, which name is now known to include a very large number of species.

R. F. S.

---

[1] Th. Hincks.—A History of the British Marine Polyzoa. 2 vols. London, 1880.

[2] L. R. Thornely.—Polyzoa from Ballycastle and Rathlin Island. *Irish Naturalist*, vol. xi, 1902.

NEMERTINEA.

This group also used to form one of the old divisions of the Vermes. It includes mostly marine worms, which are often of considerable length, and which may be found under stones between tide marks. Many resemble a coiled and twisted mass of a slimy piece of string. A useful list of the Irish Nemertinea[1] has recently been published, but much remains to be done in this and other groups of worms. *Carinella annulata*, *Eunemertes gracilis*, *Amphiporus lactifloreus*, and *Lineus gesserensis* were all taken by Thompson in Belfast Lough; while Dr. Jameson found *Cephalothrix bioculata* at Ballycastle, County Antrim. Other species, such as *Tetrastemma melanocephalum* and *Lineus longissimus* were dredged by Thompson in Strangford Lough.

R. F. S.

PLATYHELMIA.

The animals formerly grouped under one general term "Vermes" or Worms, are now broken up into a number of sections, one of which, the Platyhelmia, includes what are commonly known as "Flat Worms." Many of these—the flukes and tapeworms for example—are internal parasites, and some produce much-dreaded diseases in man and animals. There are the three following divisions:

Turbellaria.—The Turbellaria are mostly non-parasitic flat worms living in salt and fresh water. Since the late W. Thompson's researches into the marine fauna of Belfast Lough and neighbouring sea coasts, no one has made any special studies of the district as regards Platyhelmia; and, as it is often difficult to identify the species he observed from the descriptions given, only a meagre account of them can be given.

Leptoplana tremellaris is common in Belfast Lough, and *Eurylepta cornuta* occurs among Laminariæ, while *Prostheceræus vittatus* was once dredged by Messrs. Hyndman and Thompson in Strangford Lough. On the shores of

[1] H. L. Jameson.—The Irish Nemertinea (with a list of those contained in the Dublin Museum). *Proc. R. I. Acad.* (3rd s.), vol. v, pp. 34–39, 1898.

Lough Neagh *Planaria lactea*, *P. torva* and *Polycelis nigra* are abundant.

Trematoda and Cestoda.—It is not necessary to mention the particular species observed by Thompson and others in the district, as they include mostly forms common all over the British Isles, but attention should be specially drawn to a series of papers[1] by the late Dr. Drummond, who made a special study of the Cestode and other parasitic worms found in fish, which he procured from the neighbourhood of Belfast.

R. F. S.

ECHINODERMA.

This group contains the animals generally known as feather-stars, star-fish, brittle-stars, sea-urchins, and sea-cucumbers. The principal feature of the Echinoderma is the deposition in the integument of a crystalline deposit of carbonate of lime, which may be in the form of minute spicules or plates which may sometimes form a more or less continuous skeleton. Another feature is the radiate structure, at once recognised in the ordinary star-fish.

These animals are usually marine in habit, but a few live in brackish water.

The Echinoderma are divided into seven classes, two of which are extinct: the remaining five—*Crinoidea*, feather-stars; *Asteroidea*, star-fish; *Ophiuroidea*, brittle-stars; *Echinoidea*, sea-urchins; *Holothurioidea*, sea-cucumbers—are represented on our shores.

Crinoidea.—The Rosy Feather-star *(Antedon bifida)* is generally distributed off the coast in deep water up to about 100 fathoms, appearing in some places in great abundance; and the rather doubtful species, *A. Milleri*, has been recorded from Belfast.

Asteroidea.—The common Star-fish *(Asterias rubens)* is generally distributed round the coast; the spiny *A. glacialis* and the small form *A. hispida* have occasionally been taken. *Henricia sanguinolenta* and the Sun-stars, *Solaster papposa* and *S. endeca*, are of frequent occurrence on oyster-

[1] J. L. Drummond.—Notices of Irish Entozoa. *Magazine of Natural History*, vol. ii (N. S.), 1838.

banks ; they may also be found on the rocks at low water, and are sometimes cast up on the shore. The peculiar Bird's-foot Star-fish *(Palmipes placenta)* has been found on the coasts of Antrim and Down, also the small *Asterina gibbosa*, the smallest of the British Asteroidea. *Porania pulvillus* has been taken in Belfast and Strangford Loughs, and *Astropecten irregulare* in rather deep water off the coasts of Antrim and Down; but neither of the two species of *Luidia* —*Luidia Sarsi* and *L. ciliaris*—appears to have been recorded from these coasts, although both are common on the west coast of Ireland.

Ophiuroidea.—This class is well represented on our coasts. *Amphiura Chiajii* and *A. filiformis* are recorded from the coast of Down, and *Ophiactis Balli* from the Giant's Causeway. *Ophiura ciliaris*, *O. albida*, *Amphiura elegans*, *Ophiopholis aculeata*, and *Ophiocoma nigra* are generally distributed. The common Brittle-star *(Ophiothrix fragilis)* is exceedingly common, occurring at all depths from low-water mark to about 50 fathoms, and often in great numbers. The long-armed Brittle star *(Ophiocnida brachiata)* has been found in Belfast and Strangford Loughs and off the coast of Down ; this species has been recorded from Kenmare River, but appears to be rare on the Irish coast

Echinoidea.—The Common Sea-urchin *(Echinus esculentus)* and the small *E. miliaris*, easily recognised by its comparatively long spines tipped with purple, are generally distributed. A specimen of the Purple Egg-urchin *(Strongylocentrotus lividus)*, a characteristic species of the west coast of Ireland from Cork to Donegal, is stated by Dr. Dickie[1] to have been cast up on the shore at Carrickfergus. The Green Pea-urchin *(Echinocyamus pusillus)*, the least of the British Echinoidea, is common in rather deep water off the coasts of Antrim and Down ; also the Purple Heart-urchin *(Spatangus purpureus)*. The common Heart-urchin *(Echinocardium cordatum)* is frequently thrown up on the sandy coasts ; and *E. flavescens* has occasionally been taken in rather deep water. A single specimen of the rare Fiddle Heart-urchin *(Brissopsis lyrifera)*, at once recognised by the

[1] G. Dickie.—Remarks on the Distribution and Habits of *Echinus lividus*. *Rep. Brit. Assoc.*, 1852, part 2, p. 72.

lyre or fiddle-shaped impression on the dorsal surface, was dredged in mud in 25 fathoms outside Strangford Bar in 1857 by Dr. Dickie.[1]

Holothurioidea.—Several representatives of this class have been found on our shores. *Synapta inhærens* was recorded by Wyville Thomson as abundant in mud banks on the shores of Belfast and Strangford Loughs, and has been stated to occur in considerable numbers in sandbanks off Holywood; a specimen of *S. digitata* was found near Carrickfergus by Mr. Hyndman and Mr. Thompson. *Cucumaria pentactes*, *C. lactea*, and *Thyone fusus* have been obtained in Belfast and Strangford Loughs; *Cucumaria Hyndmani*, *Phyllophorus Drummondi*, and *Psolus phantapus* in Belfast Lough; and a specimen of *Cucumaria hyalina* is stated by Dr. Dickie to have been obtained by Mr. Hyndman and Mr. Thompson in 15 to 20 fathoms in Strangford Lough.

A. R. N.

COELENTERATA.

Hydrozoa.—A considerable number of Hydroid Zoophytes have at various times been obtained on the coasts of Antrim and Down, but most of the species, however, are generally distributed round the shores of Great Britain and Ireland.

Specimens have been obtained at various parts of the N.E. coast of Ireland by Dr. Drummond, Messrs. Hassall, Hyndman, Templeton, Thompson, and others; several species were dredged in the neighbourhood of Belfast Lough, in 1856–58, by the Belfast Dredging Committee of the British Association, and a list of Zoophytes received from the north of Ireland is given by Prof. Wyville Thomson in the Brit. Assoc. Rep., 1857.

Among the less common forms may be mentioned—*Eudendrium rameum*; *Tubularia larynx*; *Ectopleura Dumortieri*, recorded from Belfast Lough by Wyville Thomson, but the specimens are believed by Hincks to be referable to some other species; *Obelia gelatinosa*; *Campanularia*

[1] G. Dickie.—Report on the Marine Zoology of Strangford Lough, Co. Down, and corresponding part of the Irish Channel. Echinodermata. *Rep. Brit. Assoc.*, 1857, p. 111.

Hincksii; C. integra; C. angulata; Campanulina turrita, described by Hincks from a drawing supplied by Wyville Thomson, who found it very abundant on *Zostera* at Holywood, Belfast Lough; *Opercularella lacerata; Lafoëa parvula*, described by Hincks from a specimen on a fragment of *Nitophyllum* from the north of Ireland; *Halecium muricatum; Sertularia filicula; S. cupressina; Thuiara thuia; T. articulata; Aglaophenia pluma; A. myriophyllum; Plumularia catharina; P. similis; P. frutescens.*

The freshwater Hydroids, *Hydra vulgaris* and *H. fusca*, have been recorded from the north of Ireland.

Very few Hydroid Medusæ have been taken on the N.E. coast of Ireland since the days when Prof. Forbes, Messrs. Hyndman, Patterson, and Thompson collected in this locality. An account of their discoveries is given in Forbes' *Monograph of the British Naked-eyed Medusæ*, and in Thompson's *Natural History of Ireland*, vol. iv. Since the publication of this volume, a supposed new species of Thaumantias *(Thaumantias Pattersonii)* has been described by J. R. Greene[1] from specimens taken in Belfast docks, but it is referred doubtfully by Haeckel to *Tiaropsis multicirrata* Sars; and a supposed new species of Turris *(Turris constricta)* has been described by Patterson[2] from specimens obtained in Strangford Lough.

A few Siphonophores are occasionally found on the British coasts, principally after storms, and examples of the genera *Diphyes*, *Velella*, and *Agalma* have been recorded from the N.E. coast of Ireland.

Scyphomedusæ.—The common Jelly-fish *(Aurelia aurita)* and specimens of *Cyanea* are sometimes abundant on the shores of Belfast Lough; a few other species of Scyphomedusæ have occasionally been observed.

Actinozoa.—This group contains the Sea Anemones and the Corals; the former may often be seen adhering to rocks, sea-weeds, etc., at low tide.

---

[1] J. R. GREENE.—On the Acalephæ of the Dublin Coast, with Descriptions of Seven New Naked-eyed forms. *Nat. Hist. Rev.*, iv, 1857, *Proc.*, pp. 242–250.

[2] R. PATTERSON.—On a New Naked-eyed Medusa. *Proc. Dublin Univ. Zool. and Bot. Assoc.*, i, 1859, pp. 279–281.

Very few species have been obtained on the coasts of Antrim and Down, probably due to the very limited search which has been made for them on this part of the Irish coast. Although the N E. coast of Ireland may not be so rich in these animals as the S.W. coast, yet doubtless many additional species would reward a careful investigation of the coast of this district.

Anemonia sulcata Penn. *(Anthea cereus* Ellis*), Actinia equina* L. *(A. mesembryanthemum* E. and S.*), Cereus pedunculatus* Penn. *(Sagartia bellis* E. and S.*),* and *Metridium senilis* L. *(Actinoloba dianthus* Ellis*)* are generally distributed. *Cylista viduata* Müll. is recorded by Thompson from Bangor, Co. Down; *C. coccinea* Müll. appeared to Hyndman[1] to be not unfrequent on stones and shells from deep water in Belfast Lough; and Dr. E. P. Wright[2] said he had seen specimens of *C. undata* Müll. *(Sagartia troglodytes* Johnst.) from Belfast, and thought he had taken this species near the Giant's Causeway and at Portrush. *Tealia crassicornis* Müll. has been dredged in deep water off the coasts of Antrim and Down; *Adamsia palliata* Bohadsch and the red variety of *Corynactis viridis* Allman have been procured by dredging in Belfast and Strangford Loughs. *Epizoanthus Couchii* Johnst. is recorded by Thompson as having been dredged by Hyndman and himself in Strangford Lough; but according to Haddon and Shackleton[3] it may or may not be this species.

The Cup Coral *(Caryophyllia Smithii* Stokes*)* has been dredged, living in 75 fathoms, off the Maidens; and *Sphenotrochus Wrightii* was described by Gosse from specimens (possibly fossil) dredged on the Turbot Bank by Hyndman.

Alcyonium digitatum L.—often called "Dead Man's Fingers" or "Dead Man's Toes"—is common on the coasts of Antrim and Down; a few individuals of *Sarcodictyon*

---

[1] G. C. Hyndman.—Report of the Belfast Dredging Committee for 1859. *Rep. Brit. Assoc.*, 1859, pp. 116–119.

[2] E. P. Wright.—Notes on the Irish Actinidæ, with especial Reference to their Distribution. *Proc. Dublin Univ. Zool. and Bot. Assoc.*, i, 1859, pp. 174–188.

[3] A. C. Haddon and Miss A. M. Shackleton.—A Revision of the British Actiniæ, part 2. The Zoantheæ. *Sc. Trans. R. D. S.*, iv (2), 1891, pp. 609–672.

catenata Forbes are recorded by Thompson as having been found off Whitehead, County Antrim, and this species has been subsequently recorded from Belfast Lough by Hincks. *Virgularia mirabilis* Müll. has been often dredged in Belfast Lough.

Ctenophora.—Since the late Mr. R. Patterson contributed various papers on our native species, the study of this small group has been much neglected in Ireland, and very few specimens have been collected on the N.E. coast.

A. R. N.

PORIFERA.

A considerable number of Sponges have been found on the coasts of Antrim and Down. Most of the common and widely-distributed species and a few of the rarer forms are mentioned in Thompson's *Natural History of Ireland*, vol. iv. Several additional species are recorded in a List of Irish Sponges by Dr. E. P. Wright,[1] and by J. S. Bowerbank[2] and A. M. Norman. Strangford Lough affords exceedingly good dredging-ground for sponges, and in certain parts the bottom is said to be almost entirely covered with these animals. Many species have been obtained in this lough by Dr. Dickie and Norman, some of which have not as yet been found elsewhere.

The nomenclature is that given by Hanitsch in "Revision of the Generic Nomenclature and Classification in Bowerbank's 'British Spongiadæ.'"[3]

Calcarea.—*Leucosolenia botryoides* is generally distributed on the coasts of Antrim and Down, usually on fuci and hydroids; *L. coriacea* and *L. lacunosa* have also been obtained on these coasts. *Sycon compressum* and *S. ciliatum* are common and widely distributed. *Sycandra villosa*, *Leucandra fistulosa*, *L. nivea*, *L. Johnstoni*, and *Ascandra variabilis* are recorded from Strangford Lough, and *A. botrys* from Portrush.

---

[1] E. P. Wright.—Notes on Irish Sponges, part i. A List of the Species. *Proc. Roy. Irish Acad.*, x, 1870, pp. 221–228.

[2] J. S. Bowerbank.—A Monograph of the British Spongiadæ, vols. i–iii, 1864–1874; and vol. iv, (ed. by A. M. Norman), 1882.

[3] *Trans. Liverpool Biol. Soc.*, vol. viii, 1894, pp. 173–206.

Silicea.—*Chalina oculata* has been recorded from Belfast Lough, and is probably generally distributed along the coast; Thompson says that *C. cervicornis* has been taken in Belfast Lough by Templeton and Hyndman, but Dr. E. P. Wright thinks that the specimens were probably *Axinella stuposa*. *Pachychalina limbata* has been found on the coast of Down. *Halichondria panicea* is common everywhere; *H. ambigua*, *H. caduca*, *H. fallaciosa*, and *H. reticulata* have been taken in Strangford Lough by Norman, and *H. coccinea* in Belfast Lough by Mr. T. Higgin of Liverpool. *Reniera simulans* is probably generally distributed; *R. permollis* and *R. simplex* have been found in Strangford Lough by Norman; and *R. luteosa* was described by Bowerbank from a specimen also found in this lough by Norman. *Esperiopsis fucorum* is not uncommon on fuci, etc.; *E. gracilis* was described by Bowerbank from specimens obtained in Larne Lough by Dickie; *E. Thompsoni* and *E. imitata* from specimens obtained in Belfast Lough by Thompson. *Esperella florea* has been found in Strangford Lough by Dickie. *Dendoryx incrustans* is abundant on the coast; *D. Dickiei* and *D. Pattersoni* were described by Bowerbank from specimens obtained in Strangford Lough by Dickie; *D. Dujardini*, *Iophon nigricans* and *Plumohalichondria Kenti* have also been found in this lough. *Microciona armata* was described by Bowerbank from specimens obtained in Belfast Lough by Dickie; *Pocillon Hyndmani*, *Spanioplon armaturum*, and *Plocamia coriacea* from specimens found in Strangford Lough by Hyndman, Dickie, and Norman respectively. *Raspailia hispida* and *R. Howsei* have been found in Strangford Lough, and *Ophlitaspongia seriata* is recorded by Thompson from the coast of Down. *Hymeniacidon sanguineum*, *Suberites domuncula*, and *S. carnosus* are common in suitable localities; and *S. farinarius* was described by Bowerbank from specimens on valves of *Pecten opercularis* found in Belfast Lough by Thompson, and has since been found in Strangford Lough. *Polymastia mammillaris* was found by Templeton on the rocks at Whitehouse Point, and has been obtained in Larne and Strangford Loughs; *Cliona celata* is common; *Tethya lyncurium* was recorded from Strangford Lough by Thompson; *Leiosella pulchella* is

supposed to have been found at Carrickfergus by Templeton; and *Spongelia fragilis* var. *irregularis* may be found in suitable localities.

Of the six Freshwater Sponges recorded from Ireland by Hanitsch,[1] *Ephydatia fluviatilis* is common in suitable localities, and is the only species which has been recorded from the counties of Antrim and Down, but *Euspongilla lacustris* is probably also common. A. R. N.

PROTOZOA.—Foraminifera.

Of the 290 species of Foraminifera which are now recognised as British, about 150 have been recorded as occurring on the coasts of Down and Antrim.

When the British Association last visited Belfast in 1874, twenty-four species only had been recorded from Belfast Lough. Since that time these Microzoa have received a large amount of attention, and have been diligently searched for by members of the Belfast Naturalists' Field Club. On three occasions a steam tug was engaged by the Club for dredging excursions; dredgings have also been frequently taken by members in open row-boats, and shore gatherings have been examined at various places around the coast.

Dredgings have been taken at the following places: Belfast Lough, at from depths of 5 to 20 fathoms; Strangford Lough, 6 to 25 fathoms; off the coast from Donaghadee to Larne Harbour, 14 to 65 fathoms; off The Maidens, 60 to 72 fathoms; about midway between Belfast Lough and Portpatrick, 100 fathoms; and Church Bay, Rathlin Island, 14 to 22 fathoms.

Some years ago a very exhaustive examination was made by the late Dr. S. M. Malcomson of the rock-pools at Rockport, Belfast Lough, when he obtained 87 species of Foraminifera, the following being some of the rarer forms: *Placopsilina cenomana*, *Ammodiscus Shoneanus*, *Spiroplecta biformis*, and *Discorbina orbicularis*.

In the deep water off Island Magee and The Maidens the following species were abundant: *Gaudryina rudis*,

[1] R. Hanitsch.—The Freshwater Sponges of Ireland, with Remarks on the General Distribution of the Group. *Irish Naturalist*, vi, 1895, pp. 122–131.

Polymorphina rotundata, *Hyperammina arborescens*, *Truncatulina refulgens*, and *Pulvinulina repanda*.

On the two occasions when dredgings were taken in Strangford Lough, 100 species were obtained; at Marlpool, 20 to 25 fathoms, the porcellanous forms were very numerous and large in size; very fine specimens of the somewhat rare species, *Miliolina pulchella* and *Vaginulina legumen*, were not unfrequent.

Foraminifera are well represented in the various dredgings which have been taken. The following are some of the rarer species:

Biloculina irregularis, *d'Orb.*—Church Bay, Rathlin Island, 15 to 24 fathoms. Very rare.

Miliolina insignis, *Br.*—Two specimens of this very rare species were obtained a few miles apart, between The Gobbins and The Maidens, 60 fathoms.

M. pulchella, *d'Orb.*—Occasionally met with off the coast. Very fine specimens were got at Marlpool, Strangford Lough, 20 to 25 fathoms.

Ophthalmidium inconstans, *var.* **carinata**, *B. and W.*—Generally distributed.

Jaculella acuta, *Br.*—Off The Maidens, 60 to 72 fathoms; Church Bay, Rathlin Island, 14 to 22 fathoms. Specimens rare.

Hyperammina arborescens (*Norm.*)—Off The Gobbins and The Maidens, 60 fathoms. Most abundant.

Botellina labyrinthica, *Br.*—About midway between Belfast Lough and Portpatrick, 100 fathoms; Church Bay, Rathlin Island, 14 to 22 fathoms. Common.

Reaphax findens, *Parker.*—Church Bay, Rathlin Island, 14 to 22 fathoms. Specimens large; rather rare.

Placopsilina cenomana, *d'Orb.*—Rockport, Belfast Lough, between tides. One large specimen.

Ammodiscus charoides (*J. and P.*)—Off The Gobbins and The Maidens, 60 fathoms. Very rare.

A. Shoneanus, *Siddall.*—Rockport, Belfast Lough, between tides, frequent. Strangford Lough, very rare.

Spiroplecta sagittula (*Defr.*)—Frequent almost everywhere. The spiral arrangement of the early chambers is best seen when the specimens are mounted in Canada balsam.

S. biformis (*P. and J.*) — Rockport, Belfast Lough, between tides. Rather rare.

Gaudryina rudis, *Wright.*—Off The Gobbins and The Maidens, 60 fathoms; Church Bay, Rathlin Island, 14 to 22 fathoms. Common.

Clavulina obscura, *Chaster.*—Rockport, Belfast Lough, between tides; Strangford Lough, rare.

Bulimina subteres, *Br.*— Off The Maidens, 60 fathoms. Very rare.

Lagena semistriata, *var.* **semilineata**, *Wright.*—Newcastle, between tides.—One specimen.

L. striato-punctata, *P. and J.*—Off Whitehead, 10 fathoms; Strangford Lough, 6 to 15 fathoms. Very rare.

L. squamosa, *var.* **reticulata** (*Magill*).—Off Whitehead, 8 fathoms. Rather rare.

L. pulchella, *Br.*—Off Blackhead, 20 fathoms; off The Maidens, 72 fathoms; Rockport, Belfast Lough, between tides. Very rare.

L. marginata, *var.* **inœquilateralis**, *Wright.*— Off The Maidens, 60 fathoms. Very rare.

Frondicularia Millettii, *Br.* Off Portrush, one small specimen This is the only station where this very rare species has been found in Britain.

Lingulina carinata, *d'Orb.*—Off The Maidens, 60 fathoms. One specimen.

Vaginulina legumen (*Linné.*)—Sparingly distributed from between tides to a depth of 60 fathoms. Marlpool, Strangford Lough, 20 to 25 fathoms. At this station specimens were exceptionally fine.

Marginulina costata (*Batsch.*)—Sparingly distributed off Belfast Lough Specimens very rare.

Polymorphina rotundata (*Born.*)—Off Blackhead, 30 fathoms; off The Gobbins and The Maidens, 60 fathoms; Church Bay, Rathlin Island, 14 to 22 fathoms. Very common.

P. concava, *Will.*— Off Whitehead, 10 fathoms; off Blackhead, 20 fathoms. Very rare.

P. myristiformis, *Will.* — Rockport, Belfast Lough, between tides; off the coast from Belfast Lough to The Maidens, 10 to 65 fathoms. Very rare.

Discorbina orbicularis, *Terq.*—Rockport, Belfast Lough, between tides. Frequent.

D. parisiensis (*d'Orb.*)—Strangford Lough, between tides. Very rare. A number of good typical specimens of this rare species were got in a dredging taken in Valentia Harbour during the cruise of the "Lord Bandon" off the south-west coast of Ireland.

D. Wrightii, *Br.*—Sparingly distributed at moderate depths.

Truncatulina refulgens (*Montf.*)—Off Island Magee to The Maidens, 22 to 72 fathoms; Church Bay, Rathlin Island, 14 to 22 fathoms. Very common.

Pulvinulina repanda (*F. and M.*)—Off Island Magee to The Maidens, 22 to 72 fathoms; Church Bay, Rathlin Island, 14 to 22 fathoms. Very common.

P. Karsteni, *Rss.*—Off The Gobbins and Maidens, 60 fathoms. Very rare; specimens small.

P. patagonica (*d'Orb.*)—Rockport, Belfast Lough, between tides; off Whitehead to The Maidens, 30 to 60 fathoms. Very rare.

Gypsina vesicularis (*P. and J.*)—Sparingly distributed off Belfast Lough, 6 to 30 fathoms; Marlpool, Strangford Lough, 20 to 25 fathoms. Very rare.

Nonionina umbilicatula (*Montag.*)—Off The Maidens, 60 fathoms; Church Bay, Rathlin Island, 14 to 22 fathoms. Very rare.

N. pauperata, *B. and W.*—Rockport, Belfast Lough, between tides, frequent. Off Blackhead to The Maidens, 30 to 60 fathoms, very rare.

Operculina ammonoides (*Gron.*)—Off Blackhead, 15 to 18 fathoms; Strangford Lough, 6 to 8 fathoms. Very rare.

Fossil Foraminifera occur in the post-Tertiary clays and gravels, and the Cretaceous, Lias, and Carboniferous rocks of the north-east of Ireland. In a raised beach at Portrush, also in the gravels at the Curran, Larne, they have been found in great numbers, 60 species being obtained at both places. In the Estuarine Clay, Foraminifera often occur in abundance. At Magheramorne, on the Northern Counties Railway, a fine exposure of this clay occurs close to the ferry-slip on the north side of Larne Lough. Here

these Microzoa are in great abundance and variety. *Lagena striato-punctata*, one of our rarest recent British species, is not unfrequent. Foraminifera have been found in the Glacial drift at many places, the specimens being small in size, but in good preservation. On Divis Mountain they have been found at an elevation of 1,300 feet above the sea, but the specimens were very rare. At Woodburn Glen, about 400 feet above the sea, they occurred in great profusion, 60 species having been found at this place. At Knock Glen they were also got in great numbers, 79 species being obtained. Amongst the many very rare forms are the following: *Planispirina contraria*, *Bolivina serrata*, *B. obsoleta*, *Lagena fimbriata*, *L. clathrata*, *L. depressa*, *Rhabdogonium tricarinatum*, *Pullenia quinqueloba*, *Discorbina minutissima*, *Pulvinulina nitidula*, *Nonionina orbicularis*, and *Polystomella subnodosa*. Cretaceous Foraminifera have been found at a number of localities from Chalk powder, which is often got inside cavities in the flints. Upwards of 100 species have been identified. The genera *Textularia*, *Bulimina*, *Nodosaria*, *Frondicularia*, *Flabellina*, *Marginulina*, and *Cristellaria* are well represented. Foraminifera occur in the Lias at many places; but the best known locality for them is near Ballintoy, where they occur plentifully in the shales, the specimens being small in size, but in the finest state of preservation. Foraminifera of Carboniferous age are not unfrequent in soft bands that occur in the limestone quarries at Castle Espie.

REFERENCES.—The following are all from the *Proceedings* (and Appendices) of the Belfast Nat. Field Club, unless where otherwise stated: WRIGHT, JOSEPH: Recent Foraminifera of Down and Antrim, 1876–77. Appendix iv, pp. 101–6, Plate and Table of Distribution. *Ibid.*: Foraminifera of "Protector" cruise, and from Rockport, Belfast Lough, 1884–85, App. ix, pp. 316–26, Pl. and Tab. *Ibid.*: Some Foraminifera from Rathlin Island (Church Bay), *Irish Nat.*, vol. xi, 1902, *Ed.*

The following deal with Fossil Foraminifera: WRIGHT, J.: List of Irish Liassic Foraminifera, 1870–71, App. ii, pp. 25–6. *Ibid.*: List of Cretaceous Microzoa of North of Ireland, 1873–74. App. iii, pp. 73–100, Pl. and Tables. *Ibid.*: Post-Tertiary Foraminifera of North-east of Ireland, 1879–80, App. v, pp. 149–63. *Ibid.*: Foraminifera in Boulder Clay Deposits, 1893–4, pp. 126–7. PRAEGER, R. LL.: Estuarine Clays at Alexandra Dock, Belfast, 1886–87, App., pp. 29–51. *Ibid.*: Report on Ballyrudder Gravels, Co. Antrim, 1892–93, pp. 518–25. *Ibid.*: Estuarine Clays of the North-east of Ireland, R. I. Academy, *Proc.* 1892, pp. 212–89. Lists of Foraminifera in all the above by J. Wright.

J. W.

ANTIQUITIES.

By Francis Joseph Bigger and William J. Fennell.

Prehistoric Remains.

The north-east of Ireland is particularly strong in prehistoric remains. Carns, pillar-stones, cromleacs, stone circles abound in every district; but we do not purpose to give any lengthened or systematic account of them, only a general sketch of what may be observed.

Carns.

Almost all the high mountains have been crowned with carns, many of which have, however, in recent years been removed. The group of carns on the Slieve Croob, near Ballynahinch, are perhaps the most important, whilst others

R. Welch. THE KEMPE STONE, DUNDONALD. *Photo.*

on Slieve-a-true, near Carrickfergus, and on Carn-eigh-aneigh, between Cushendall and Ballycastle, Carn-an-truagh on Knocklayde at Ballycastle, are amongst the most important. The latter is said to mark the grave of three princesses.

Of standing stones, those of Standing Stone Hill, near Dundrod, and in Culfeightrin churchyard at Ballycastle, and one at Loughbricland, are typical examples. There is also one of the largest on the old road between Newry and Rathfriland, known as the "Long Stone." These are, perhaps, the most common of our ancient monuments.

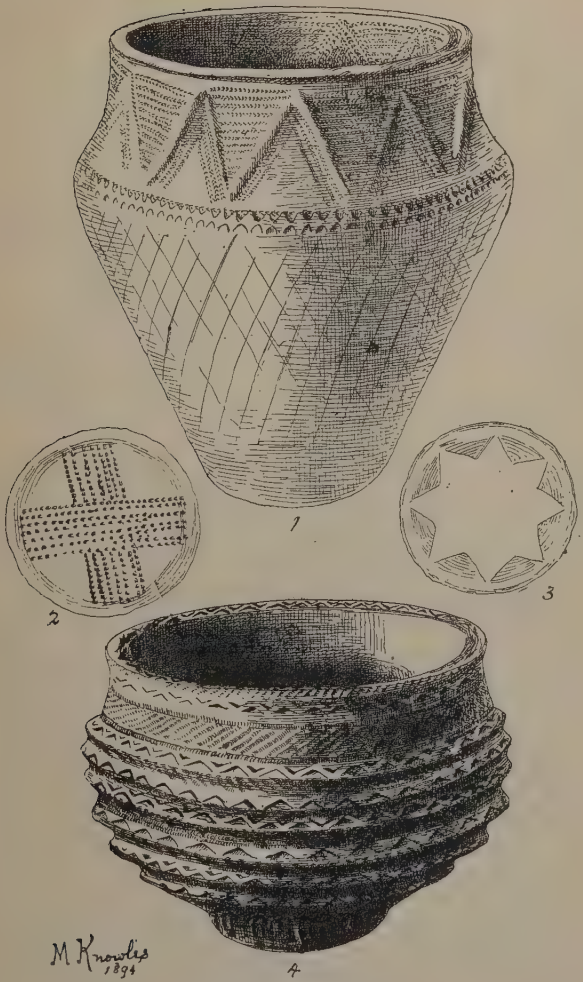
Of hole stones, the best one is in the demesne near the village of Doagh, in the county of Antrim.

Cromleacs are also fairly numerous, a good example occurring in the centre of the Giant's Ring, near Belfast. This is a place well worth visiting at any time, being one of the finest

R. Welch. THE GIANT'S RING. *Photo.*

prehistoric monuments in the north of Ireland. The rath is of most imposing dimensions, being about 600 feet in diameter, the encircling earth rampart being 80 feet wide at the base. The cromleac occupies the centre of this great ring, and was formerly surrounded by standing stones.

There are several cromleacs near Ballintoy on the north coast, and also one at Finvoy, underneath which urns were found; there are also two others at Ticloy. One of the best and most easily reached is in Island Magee, close to Larne Ferry, in the neighbourhood of which gold ornaments were discovered. At Dundonald, near the city, there is a fine example; and at Mountstewart there is quite a perfect little



COUNTY ANTRIM URNS.

No. 1.—Sepulchral Urn. No. 2.—Base of same. No. 4.—Food Urn. No. 3.—Base of same.

cromleac, which was at one time covered by a carn. A large number of urns were found around this monument. There are other examples at Loughmoney, on Slieve-na-griddle, and at Slidderyford, near Dundrum; whilst one of the finest, both in height and in the size of the covering stone, is at Legananny, five miles from Castlewellan. The largest of the local cromleacs is one at Goward, in the parish of Clonduff, consisting of a block of granite 13 feet long, 10 feet wide, and 3 feet thick, weighing about

URN FROM MOUNTSTEWART CARN.

R. Welch. MOUNTSTEWART CROMLEAC. *Photo.*

50 tons, and resting on a group of nine others. Here urns have been found. It was at one time surrounded by a circle of stones. Numerous other examples occur about the district.

F. J. B.

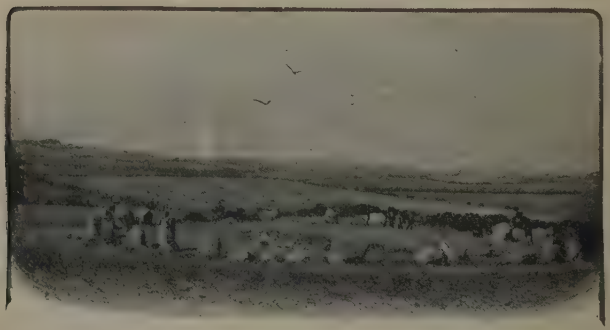
R. Welch. CROMLEAC AT SLIDDERYFORD. *Photo.*

Kiste-vaens are also fairly numerous, the one nearest the city being at The Roughfort, consisting of about forty large stones covering a chamber about 40 feet long, covered by nine of the largest blocks, the end one forming what would

R. Welch. LEGANANNY CROMLEAC. *Photo.*

R. Welch. GOWARD CROMLEAC. *Photo.*

be considered a fair cromleac. Other examples occur at Ballyhome, known as Gig-ma-gog's Grave, between Coleraine and Bushmills; one above Murlough, Ballycastle, known as Gallow-glass Grave; and one at Ballyboley, on the road between Ballynure and Larne. There is also one at Killowen, not far from Rostrevor, and another at Kilkeel.



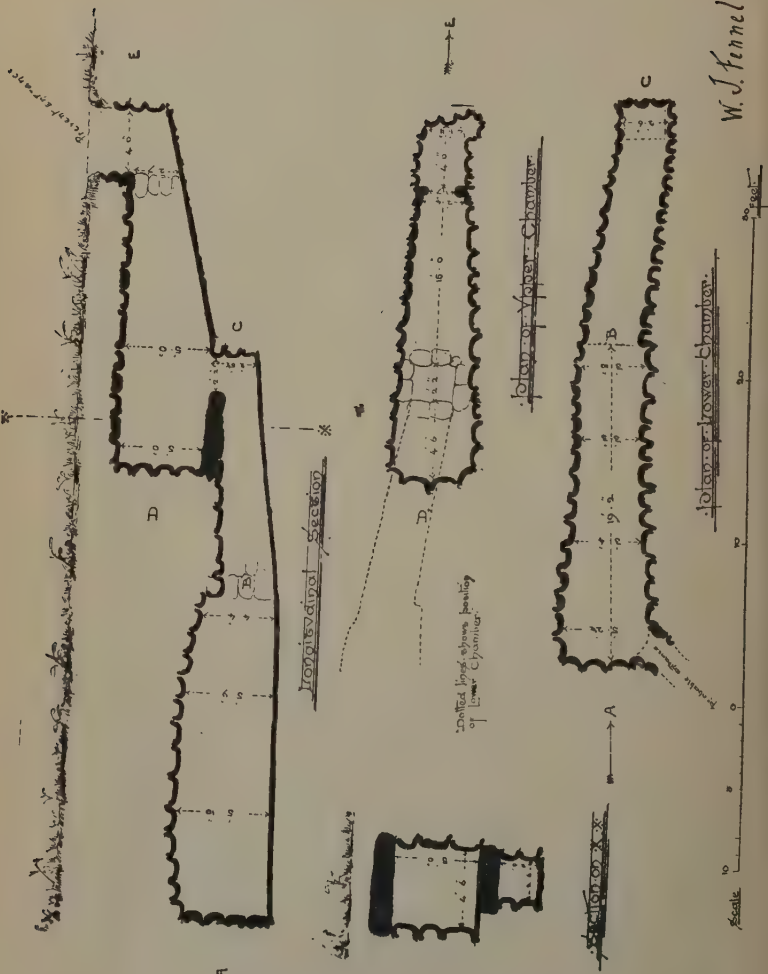
R. Welch. STONE CIRCLE AT BALLYNOE. *Photo.*

Stone circles are to be found at Ticloy, Parkgate, and Kilmakee, both the latter near Templepatrick; and also at Lubitavish, near Cushendall, where there is a group of thirty-four stones, known as Ossian's Grave. At Ballyalton, near Downpatrick, there is a circle, with an approaching avenue of stones; whilst at Ballynoe, in the same district, the best of the local stone circles is to be found. It consists of two circles, the inner about 20 yards in diameter, having twenty-two stones, and the outer about 25 yards in diameter, with about fifty stones, some of them standing 7 or 8 feet high. There are also other stones around in different positions.

F. J. B.

Artificial Caves, or Souterrains.

These structures may be regarded as the residences and retreats of one of the primitive races who inhabited this country. No two of them are alike in plan, but all have a general resemblance to one another in their mode of construction. The plan generally consists of chambers approached by long irregular passages, sometimes straight, sometimes zigzag, and often containing minor passages branching from the main one; these passages vary from 2 feet wide to 3 feet, seldom more; and the heights range from 2 feet 6 inches to 6 feet; while the chambers, shaped like beehives, swell out to greater areas and more lofty domes. The entrances to these chambers are protected by barriers, sometimes single, and often double, and even triple, rendering invasion an impossibility when a determined foe with a weapon was there to resist. The chambers vary in length up to 20 feet, but the passages often extend to over 100 feet. In every case these dwellings are built of rough unhewn stones, frequently of boulders, with an incline inwards towards the top, where they are covered with large flat stones, and in most cases they appear to have been built first and then covered over with earth. Often there are sewer-like passages leading to the surface which may have served for the circulation of air, and their outlets were carefully concealed or rendered unattractive from their positions. These dwellings are profusely scattered over both counties, and are found in most unexpected places—often in

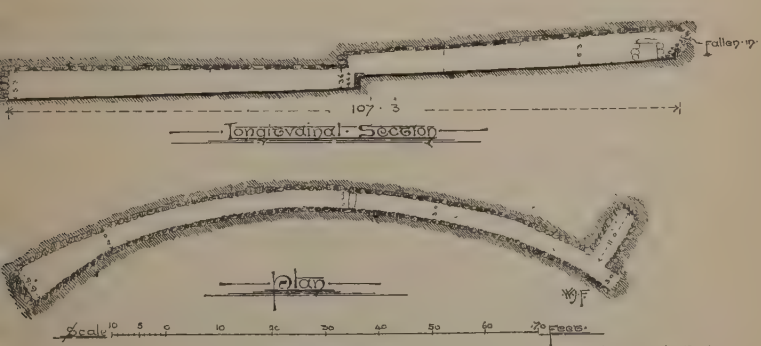


PLANS AND SECTIONS OF SOUTERRAIN AT MUCKAMORE.

forts or raths, in which case the flue runs to the outer side of the sloping bank of the rath. One of the nearest to Belfast, easily approached and entered, is on a farm at Bog Head, on the Six-mile Water, in the Grange of Muckamore, near the town of Antrim. This souterrain has the singular peculiarity of being two-storied. It is easy of entrance, and well worth a visit.

A very fine example of a souterrain inside a fort may be inspected at Stranocum, in the grounds of W. Ford-Hutchinson, which was discovered in 1897, and is like the letter F on plan. There is also an extensive one at Tyrella, in the county of Down, and within easy distance of Dundrum or Downpatrick.

Other examples more or less difficult can be found in the county of Antrim at Holywell, Dunagore, Broughshane, Glenwherry, Toomebridge, Ballycastle, and in the county of Down at Craigavad, Downpatrick, Ardtole near Ardglass, etc., but many of them have been closed up, as they were dangerous to cattle, and a visitor may be disappointed at the end of his journey. Stone implements and bones have been found in some of them, also pottery, but they have not yet been systematically investigated.

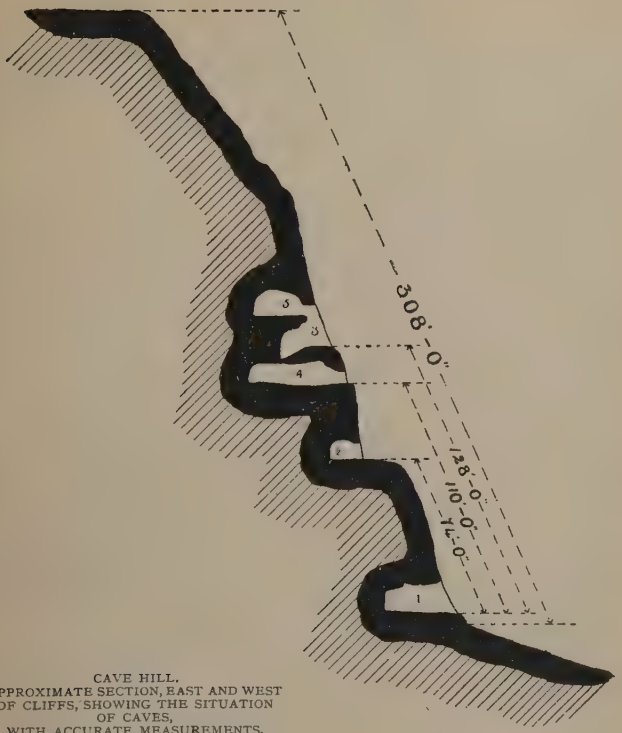


GROUND PLAN OF THE ARDTOLE SOUTERRAIN.

A few natural caves are to be found in the district around Belfast, which bear clear evidence of having been either artificially made or used by man. The principal ones are those on the Cave Hill, overlooking the city, and at the Knockagh, above Carrickfergus; whilst they are to be found here and there all round the coast from Belfast Lough to Portrush.

W. J. F.

CAVE HILL. CLIFF SHOWING THE FIVE CAVES.
From a drawing by Joseph Carey.
(See *Ulster Journal of Archæology*, vol. viii, page 81.)



CAVE HILL.
APPROXIMATE SECTION, EAST AND WEST
OF CLIFFS, SHOWING THE SITUATION
OF CAVES,
WITH ACCURATE MEASUREMENTS.
(Scale of caves twice that of cliffs.)

Drawn by Philip Reynolds.

Raths.

All varieties of earthwork are found studded over the face of the country. The largest one is at the Giant's Ring, previously mentioned; and within a short distance of it is Farrell's Fort, a very good example. They frequently have castles or churches erected upon them of a later date. It is no uncommon thing to find an ancient fort, a mediæval castle or church, and a modern dwelling-house or parish church close together, thus showing a long historical sequence of occupation by man in different ages.

The greatest of all the forts is Dunceltchair, or Dun-da-leth-glass, at Downpatrick, and it is rendered particularly interesting by the known history attached to it. Celtchair was one of the heroes of the Croibh-ruadh, or Red Branch Knights of the heroic period of Irish history, similar in time to the legends of King Arthur. Before De Courci's time the name was changed to Dun-da-leth-glass (the fort of the broken fetters). It subsequently gave the name, in Christian times, to the city of Ireland's patron saint, Downpatrick (Dunpatrick). Here King John stayed in 1220, and it was sacked and burned by Edward Bruce in 1316. This rath is of vast size, situated on the level banks of the River Quoyle, and has quite the appearance of a natural hill.

Rathmore, near Antrim town, was also burned by Edward Bruce; and close beside it is Rathbeg. Both of these forts are mentioned in ancient history.

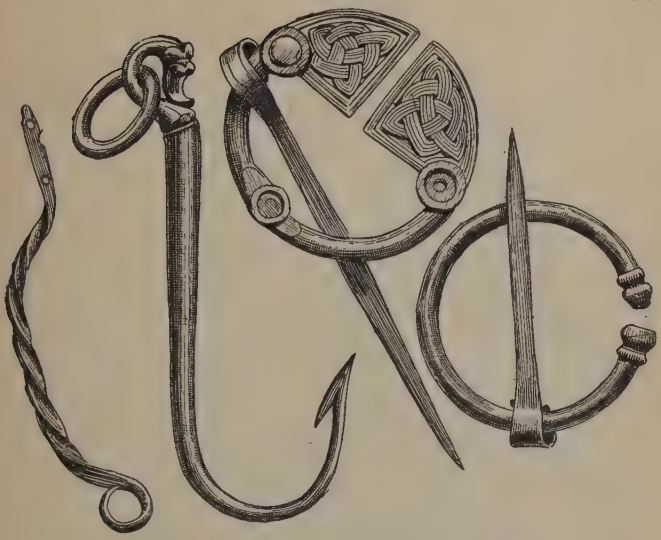
Numberless forts of all known varieties—conical, flat, round, and even square—are to be found here, there, and everywhere over the northern counties. Emania, near Armagh, is the most celebrated, on account of its historical associations with the Red Branch Knights. Many legends circle round its extensive ramparts, and the earliest traditions are associated with its site. In many respects it is the northern Tara.

F. J. B.

Crannoges.

These lake dwellings are fairly numerous, and in recent years several of them have been systematically examined, with the most satisfactory results, which have been fully described in the *Proceedings* of the learned societies. It may be noted in passing that there is clear evidence that these residences were in occupation up till the time of Queen Elizabeth.

There are several in the neighbourhood of Ballymena, and others near Toomebridge, which have been thoroughly investigated, yielding stone, bronze, iron and wooden implements in abundance.

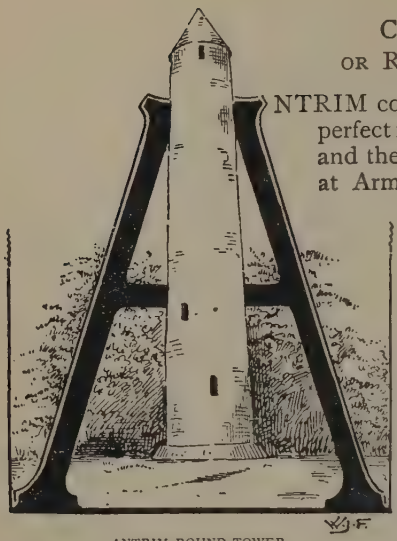


BRONZE ORNAMENTS FOUND IN THE CRANNOGE
AT LOUGH MOURNE, CARRICKFERGUS.

A unique example occurs in the great tarn on Benmore, near Ballycastle, being surrounded by a stone wall, with two distinct landing-places. The zig-zag paths to some of these crannoges have been discovered when the lakes were drained.

F. J. B.

BENMORE, BUN-NA-MARGIE, AND DUN-RAINEY,
BALLYCASTLE, CO. ANTRIM.
Drawn by John Vinycomb.



ANTRIM ROUND TOWER.

Cloic-teacs, or Round Towers.

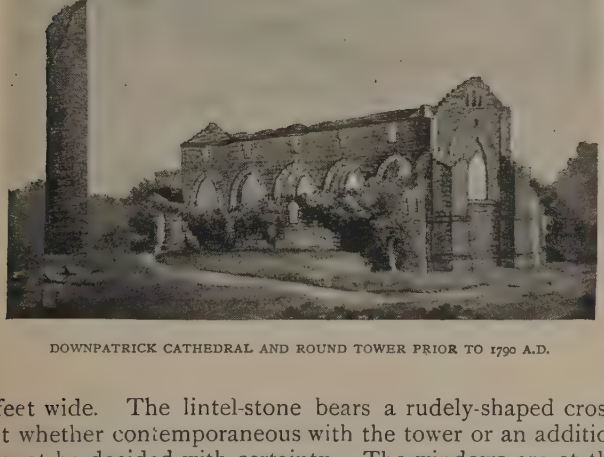
ANTRIM contains one of the most perfect round towers in Ireland, and there are remains of others at Armoy and Ram's Island, while in Down similar remains may be found at Drumbo, Maghera, and Mahee Island in Strangford Lough. These monuments are regarded as being purely national in character, unaffected by the few solitary circular towers that occur elsewhere. They possess a distinct character of their own, and a general similarity throughout Ireland, being found in almost every corner of it, and in all cases connected by evidence in stone or otherwise to the religious establishments of the early Church in Ireland; and antiquarian authorities are now fully agreed on that point, although the question of use still excites discussion.

The controversy that waged round the question of their origin was long and vexed, and many learned writers held with great tenacity to their standpoints of view from the Christian and Pagan sides. A review of the question here would be out of place, but we give in the bibliography sufficient references to satisfy the most persistent antiquary who desires further investigation.

Many of the cloic-teacs,[1] like the noble one that stood beside the old abbey at Downpatrick, have been completely removed; and several of them were fast following in the same direction, but the tide of preservation came, and they

[1] This is the Irish name for the Round Towers, and simply means "Bell Tower," another evidence of their Christian origin.

were saved. The Antrim tower is one of the most perfect in Ireland, and is the solitary remnant of the ecclesiastical foundation that once flourished round it. It rises to a height of 92 feet, and has a circumference of 50 feet at the base. The doorway is well over the ground line, with inclined jambs—a distinctive feature of the early Christian Church—about 5 feet 6 inches high, and the ope is about



DOWNPATRICK CATHEDRAL AND ROUND TOWER PRIOR TO 1790 A.D.

2 feet wide. The lintel-stone bears a rudely-shaped cross, but whether contemporaneous with the tower or an addition cannot be decided with certainty. The windows are at the top, and face, as is the usual custom, the points of the compass, and the stone roof is conical; so that, in nearly all respects, it is a typical example.

Margaret Stokes classified all the round towers of Ireland according to the average styles of their masonry and apertures, and that of Antrim comes under the first or earliest style; viz., "Rough field stones untouched by hammer or chisel, not rounded but fitted by their length to the curve of the wall, roughly coursed, wide jointed with 'spalds' or small stones fitted into the interstices, mortar course, unsifted sand or gravel." From this they graduated

to the fourth class, in which the masonry is "closely analogous to the English-Norman masonry of the first half of the twelfth century," and the Hiberno-Romanesque ornament began to appear, so that the range of time through which the tower building passed may have extended from the ninth till the thirteenth century. "The Belfast Museum contains a large number of skulls of persons who were buried in and about the round towers. In some cases the remains were under the foundations." See *Ulster Journal of Archæology* (old series), Petrie's *Round Towers*, Margaret Stokes's *Early Christian Art in Ireland*, Vallancey's *Collectanea*, *Round Towers* by S. J., and *Round Towers* by O'Brien.

W. J. F.

R. Welch. THE RESTORED TOWN CROSS OF DOWNPATRICK. *Photo.*

Ancient Crosses.

We do not possess in Ulster many examples of the sculptured crosses that form so distinguished a feature as memorials of the early Christian Church in Ireland, and

R. Welch. HIGH CROSS AT ARDBOE (EAST FACE). *Photo.*

whose dates may be limited to a period ranging from the tenth to the thirteenth century, but we lay claim to some vigilance for the protection and preservation of such relics as time and circumstances have brought to light. The

R. Welch. HIGH CROSS AT ARDBOE (WEST FACE). *Photo.*

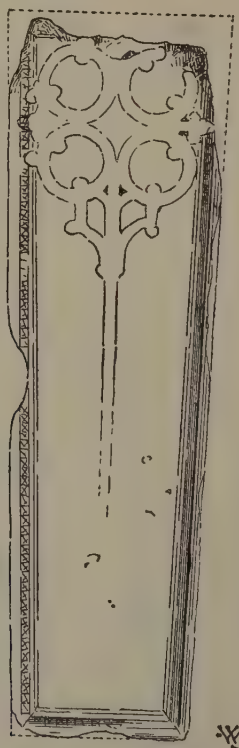
ancient high cross of Downpatrick has been re-erected, the different portions being gathered together from places where they had lain in neglect for many years, and it now stands prominently before the east end of Down Cathedral. The interlacing ornament of the panels and the crucifixion

Incised Stone

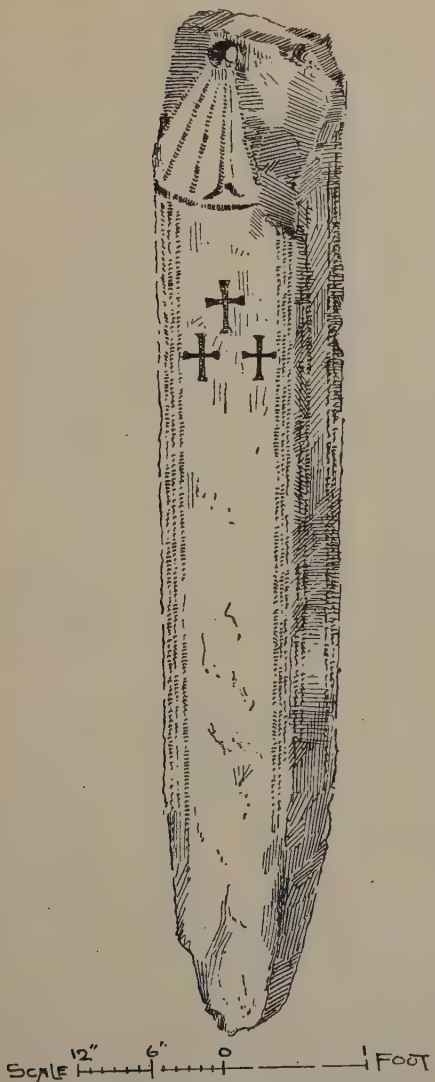
Dug up in Bangor Churchyard in 1899. *Drawn by W. J. F.*

can still be traced on its weather-worn face. Fragments of another cross at Downpatrick have been placed inside the cathedral for protection until the remaining pieces have been found. The cross of Dromore possesses a similar history of restoration to that of Downpatrick, as does that of Donaghmore, but is not so perfect. The Downpatrick cross stands in the cathedral yard, facing the main street of the town. The cross of Ardboe, in the county of Tyrone, on the shores

of Lough Neagh, may be considered the most important in Ulster for its size and elaborate carving. It is, however, outside the Belfast district, but easily accessible either from



Cookstown or Toomebridge, and is well worthy of a visit, as it undoubtedly ranks amongst the finest of our Irish crosses. It stands 18 feet 6 inches high, and is 3 feet 6 inches



SUN-DIAL (?) CROSS, NOW AT BANGOR CASTLE.
From a drawing by W. J. Fennell.

across the arms, and has twenty-two panels containing sculptured scriptural subjects. (See *Ulster Journal of Archæology*, N.S., vol. iv, page 1, for a full description and illustrations.) This cross has been well cared for, and is still in excellent preservation. The visitor to Ardboe should study the old churches close by this cross. Other crosses at Drumgooland, Armagh, Donaghmore, and in Tynan Abbey demesne and at Caledon are worthy of inspection.

A number of rudely-cut crosses and fragmentary pieces are scattered profusely over the counties of Down and Antrim, and may be looked for at Newtownards, Bun-na-margie, Cushendun, Connor, Kilroot, Carrickfergus, Temple Astragh, Maghera, Bangor Abbey Church, etc.; but none of the elaborately-carved slabs so common at Clonmacnoise and similar places are to be found here. (See *Ulster Journal of Archæology; Early Christian Art in Ireland*, by Margaret Stokes; O'Neill's *Sculptured Crosses of Ancient Ireland.*)

W. J. F.

Sculptured Slabs.

The cuneiform slabs, mostly Anglo-Norman, but some few dating from the earlier period of the Celtic Church, occur frequently throughout both Antrim and Down, and present

ANGLO-NORMAN GRAVE-SLAB, MOVILLA.

an interesting subject of monumental study. The richest collection in one place is in the old ruined Abbey of St. Finian, at Movilla, about a mile east of Newtownards, one

of them bearing an inscription in the Irish character—"Ordo Detrend"—i.e., "a prayer for Detrend," who was possibly an abbot of Movilla about the end of the tenth century. This fine collection has been erected against the north wall of the church for preservation. These Norman stones are without inscriptions, but emblems are frequent and suggestive, such as leaves on the stem of the cross, as it constituted the tree of life, a chalice or pastoral staff to denote an ecclesiastic, a sword for a knight, and an old time shears or scissors to denote a woman, or, as some say, a yeoman or shearer. There are several fine cross slabs of Norman origin now well conserved in the Abbey Church of Bangor.

Greyabbey, in the county of Down, contains two fine slabs, one bearing the recumbent effigy of Sir John de Courci, a cross-legged warrior of the thirteenth century, while the other bears the effigy of his wife, the Lady Affreca, the foundress of the abbey.

Examples of cross-inscribed stones can also be seen at Dundonald, Holywood, Maghera (Co. Down), Belfast Museum, Inishargie, Bangor, Kilroot, Carrickfergus, etc. Most of these have been illustrated in the *Ulster Journal of Archæology*.

W. J. F.

Ancient Churches.

The churches of the united dioceses of Down and Connor and Dromore should be classed under the heads of pre- and post-Reformation, and the mind of the antiquary will naturally turn to the former, although the latter have also an interest of their own. Amongst the first, the more important churches left to us are the cathedral church of Downpatrick, and the church of St. Nicholas at Carrickfergus, both within easy reach of Belfast.

The Church at Downpatrick is the cathedral of the diocese of Down, and is large, heavy, and, from an architectural point of view, not very interesting; but the old foliated capitals of the pillars are good and refined pieces of sculpture. The church was restored from ruin about 1790, and the result is what might be expected from a time when church

architecture was at a low ebb. This church receives a dignity from its size and its position, crowning the summit of a hill, its lofty square tower forming an attractive landmark. Like most churches, the legend hangs round it that it occupies the site of the first Christian church, and even that of a still earlier Pagan temple. These gave place to a Benedictine abbey, dedicated to the Holy Trinity, which was founded by Sir John de Courci, who more than any other man has left his mark on the county of Down.

R. Welch. DOWNPATRICK CATHEDRAL FROM THE EAST. *Photo.*

The great interest that centres round this church lies in the associations that the place has with the patron saint of Ireland, whose remains, together with those of Saints Columba and Brigid, were translated to it in 1186, "under the auspices of Sir John de Courci, and in presence of Cardinal Vivian, who had come from Rome to witness the ceremony." It is easy to understand how venerated must have been the spot that contained the relics of three such illustrious saints; but all the sanctity and love did not prevent contending foes from destroying De Courci's church, and the precise place where the saint was buried is now

R. Welch. THE OLD CHURCHES AT LOUGHINISLAND. *Photo.*

traditionally fixed on a spot a few yards to the south of the church; and as there is always a germ of truth in every legend, it may be regarded as fairly accurate in its location. The visitor should visit this spot, which has been recently

R. Welch. THE GRAVE OF SAINT PATRICK AT DOWNPATRICK CATHEDRAL. *Photo.*

covered with a memorial, the character of which is in keeping with that which would have suggested itself to the early fathers of the fifth century who laid the Apostle of Ireland

n his grave. The incised cross and the lettering of his name are copied from coeval authorities.

This church was rebuilt according to modern ideas of Gothic art as they existed in the eighteenth century, and the remnant of the round tower was removed as unsightly and dangerous. The battle-flags of County Down regiments have been hung in this church, and should be inspected. It also contains a number of interesting monuments, including one of the Cromwell family.

Church of St. Nicholas, Carrickfergus.—From an antiquarian point of view this church is the most interesting one in the united diocese, and is a suggestive object-lesson of how a great church—a sister church to St. Nicholas of Galway—possessing nave and aisles, transepts, side chapels, and all the attributes that render a church a dignified and noble structure, both reverend and attractive, can, by time and a series of successive changes, each one on the downward grade, alter the whole from the full beauty it once possessed to a much smaller and debased structure. For a complete history of these changes, we must refer the reader to the report of Sir Thomas Drew to the Diocese in 1874.

The lines of the nave arches are still traceable on the exterior of the south side. Notice should be taken of the Chichester monument, which of its kind is very fine, and records about the founder of the house of Donegall "not what he was, but what he should have been." One group of churches on Loughinisland, near Crossgar, is particularly interesting.

Numerous other smaller churches, their ruins or their sites, are to be found in every parish. The one, however, which will excite most admiration is the Bishop Jeremy Taylor church at Ballinderry, now completely restored. It was built at the Restoration by the learned Bishop of Down, who did not, however, live to see it completed. It was here he took refuge from the Puritans, and here many of his works were penned. The church itself is quaint and simple, with its heavy oak from the now denuded forests of Ballinderry, and its square windows. The interior still preserves all the original oak fittings, as constructed in the time

of the second Charles, the old arrangements being strictly adhered to. It is well worthy of a visit.

W. J. F.

W. J. Fennell. *Photo.*

INTERIOR VIEW OF THE BISHOP JEREMY TAYLOR CHURCH, LOOKING EAST, AND SHOWING THE OAK PULPIT AND PRAYER DESK, ETC.

Abbeys.

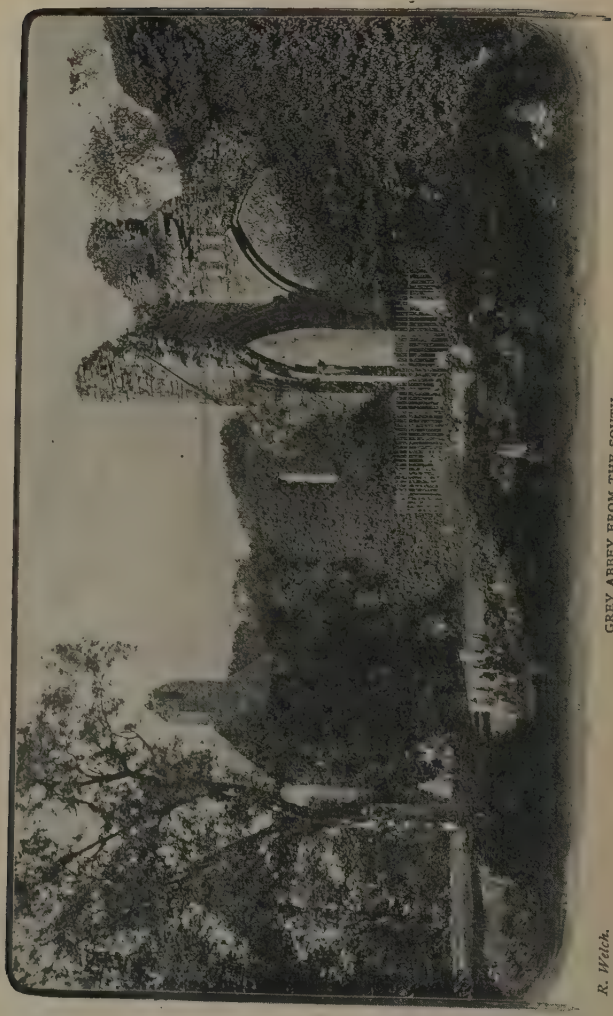
The northern counties are by no means rich in the great mediæval structures which are found so frequently in the southern counties. What did exist have been largely swept away, or only the smallest fragments left—often the sites alone are known.

Of Celtic foundations, that possessing one of the longest histories is, perhaps, in Nendrum, or Mahee island in Strangford Lough, fully recorded by the late Bishop Reeves. Only a few foundations and the base of a round tower now exist. Movilla, near Newtownards, was also a celebrated school of learning in the earliest ages. Several cross slabs still remain here, and a more recent church; but the great abbey

THE CLOIC-TEAC (ROUND TOWER) ON INIS-MAHEE, 1902.
Drawn by Joseph Carey.

of Bangor, on account of its school of learning and the many pious men it sent over all Europe, is best known. Of it, none of the very ancient structure remains, and but a few fragments of the walls of an abbey dating from Norman times, and some cross slabs, are to be found. What the northmen failed to obliterate, more modern devastators have effectually cleared away.

Of great Norman abbeys, the only one left to us having any imposing dimensions is that of Grey Abbey, beautifully

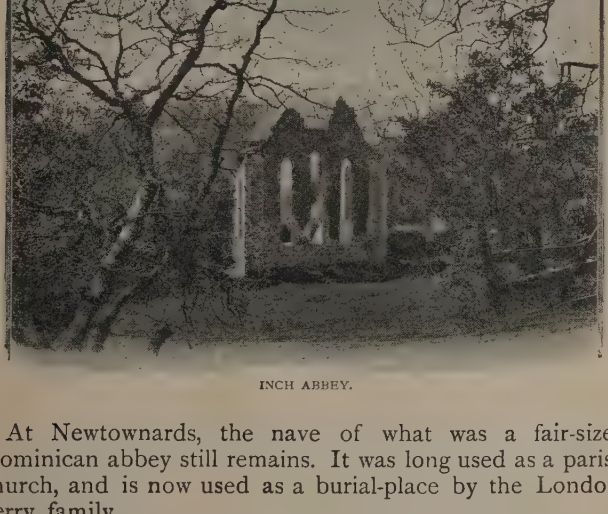


GREY ABBEY FROM THE SOUTH.

R. Welch. *Photo.*

situated on the shores of Strangford Lough. This was a Cistercian house, and was founded in 1193 by Affreca, wife of John de Courci, and daughter of Godfrey, king of Man.

Close to Downpatrick are the remains of Inch Abbey, which must also have been a very extensive house; but the choir alone remains, of considerable beauty, with its long lancet windows.



INCH ABBEY.

At Newtownards, the nave of what was a fair-sized Dominican abbey still remains. It was long used as a parish church, and is now used as a burial-place by the Londonderry family.

Other abbeys there are none, save the poor little late Franciscan house of Bun-na-Margie, on the north coast, near Ballycastle, which however occupies a glorious site and has a romantic history.[1] The Normans never attained a firm foothold in Ulster, save in the strongholds of Downpatrick and Carrickfergus, and thus had no opportunities for founding houses suitable for the great religious

[1] "Bun-na-Margie," by F. J. Bigger. Special Part of *Ulster Journal of Archæology*. M'Caw, Stevenson & Orr, Ltd., Belfast.

orders. The early Irish monastic system was quite different from the Norman, and had very few features in common with it.

F. J. B.

Castles.

Long before the raths or crannoges fell into disuse throughout our district, substantial castles were built of stone and mortar, particularly along the coast. Sir John de Courci, after his descent on the north-east of Ulster, promoted the building of strongholds in various parts of the country; and his numerous followers, anxious to secure the lands they had acquired by the sword, imitated the policy of their leader, and built castles upon their several estates in which to entrench themselves in those troublous times. A document of the time of Elizabeth, now in the British Museum, states that the principal means used to reduce Ireland were—"By restraining and taking from the Irishry, by little and little, all trust of government: by building of castles and fenced houses, and committing the captaineries to trustie and well-affected English." And not only were castles built, but those who lived in them were obliged to keep them in repair. In the time of Richard II. it was ordered "that all who have castles or fortresses in Ireland should cause them to be repaired, and hold them in proper condition, and place therein a good and sufficient ward for their safe keeping."

This order was most cheerfully obeyed. It fitted in with most perfect harmony to the tastes of the barons and adventurers of the time; and the great number they built —and they stud the land on almost every point of vantage—together with the existing castles and strongholds of the Irish chiefs, speaks with no uncertain voice of the very lively times that existed, first amongst the Irish themselves, and then in the everlasting line of warfare that continued between the English to gain and keep, and the Irish to retain their own—a state of affairs that continued for ages.

Of these martial strongholds the nearest to Belfast is that of Carrickfergus, which claims an unbroken line of military

occupation from its foundation till the present day. This castle was built by Hugh de Lacy, and is erected on a basaltic dyke on the rocky shore; it had therefore the sea, which washed its feet, as a protection on half its circumference, and possibly had a moat on the land side. Its position was one of great strategic importance, and was the key to the north-east corner of Ireland; no invader could afford to pass it and thus destroy his base of action. A town soon gathered around it, and was ancient, or middle-aged, before Belfast existed or attained to the extent and dignity of a village. The history of this castle is full of stirring events and stormy vicissitudes, of capture and re-capture.

CARRICKFERGUS CASTLE.

William III. landed close to this castle in order to commence his operations against James II. The spot is still shown.

The last episode occurred about a hundred and forty years ago, when the French, under Thurot, took the castle, plundered it, then demanded and received supplies from Belfast, and sailed away on the approach of the English reinforcements; but the triumph was short, and the "Mareschal" was taken off the Isle of Man. The attack on the castle was led by the Marquis d'Estrées, "who, seeing a child rush between the combatants, seized the lad, and breaking in a door with the butt end of a musket, placed the child in the hall of the house which happened to be that of the boy's

own father, John Seeds, the Sheriff." The notorious privateer, Paul Jones, successfully attacked H.M.S. "Drake" off Carrick on 24 April, 1778. The castle is still regarded as of sufficient importance to receive a shot or two of blank cartridge during the annual naval manœuvres.

Next in point of interest is the picturesque ruin of Dunluce Castle, which forms a most attractive feature on the visitors'

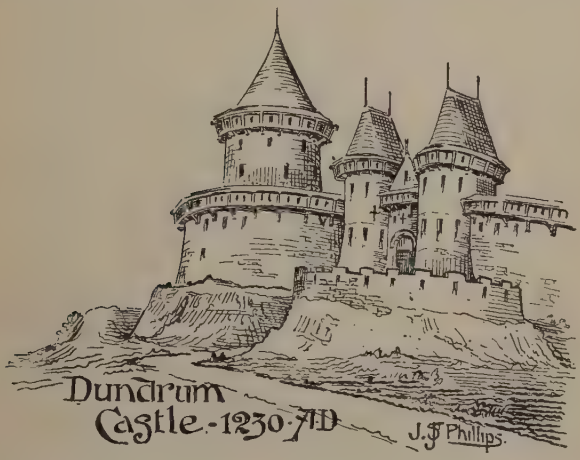
DUNLUCE CASTLE.

route to the Giant's Causeway. This castle has all the charm of romance about it, and like Mark's fabled castle in

> "Tintagil, half on sea, and high on land,
> A crown of towers,"

its striking picture is one not soon to be forgotten. A visit to it reveals the fact that, as well as a means of defence, there had also been an eye in its construction to comfort and luxury. It was on the last occasion when the great banqueting-hall was full of good cheer and hospitality that the kitchen toppled over into the sea, carrying some of the household with it; and this led to the abandonment of the castle as a

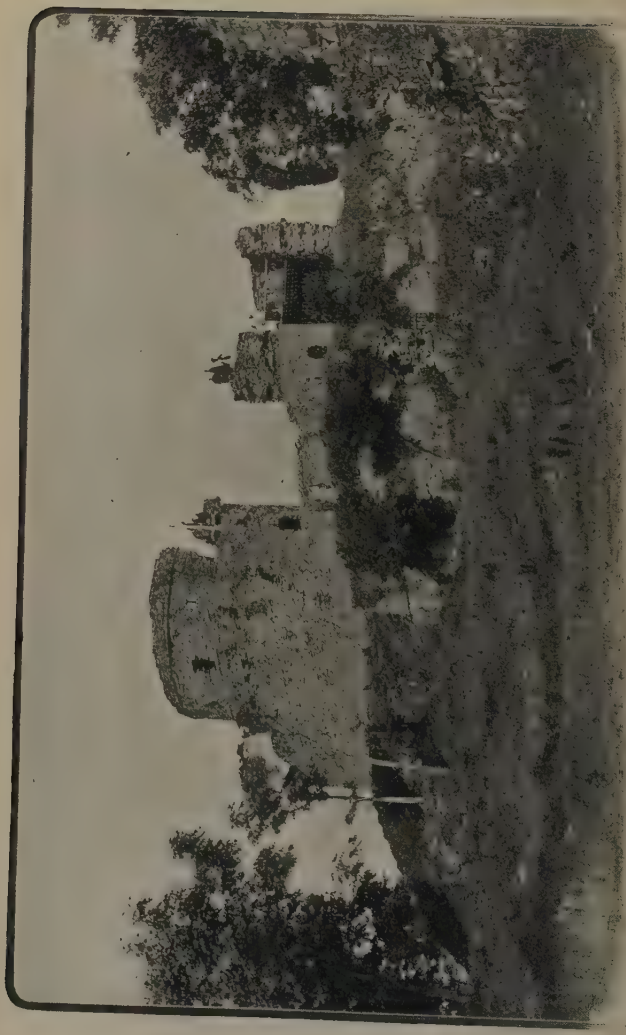
residence by the Duchess of Buckingham, the widow of the Earl of Antrim. It is still the property of the MacDonnells, Earls of Antrim, who allow people to visit and inspect the home of their ancestors. The land-side buildings, occupied only in times of quietness, were walled in, and converged to a point at the drawbridge, which was spanned by a single arch over a deep chasm, all of which bears a remarkable likeness to a sketch of the entrance to the castle in *Anne of*



Geierstein. The visitor should notice the banshee's tower, the old ovens, and the artificial channel on the north side, so that supplies could be taken in from the water side if the castle were hard pressed on the land side. From this water-way a natural tunnel runs to the lower level of the chasm above referred to.

It may not be uninteresting or out of place to notice here the small church a few hundred yards to the south of the castle, whose graveyard heaves with the mould of many noble but ill-fated sons of Spain, who perished in the wrecked galleons of the Armada on the stern headlands of this coast.

Dundrum Castle, Co. Down, built by Sir John de Courci for the Knights Templars, has a character of its own, defiantly



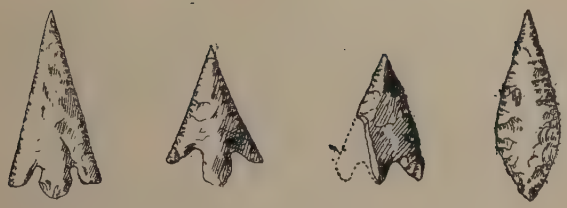
DUNDRUM CASTLE, CO. DOWN.

R. Welch. *Photo.*

Norman, and should be noted for this reason. Like many others it is well ruined.

The remaining castles are very numerous, and in every stage of decay and neglect. All of them are of great interest from the way in which their former greatness is woven into local history, and from their connection with the various Irish clans, and with English adventurers, but in size or martial construction they possess little that would arrest attention.

W. J. F.



TYPICAL COUNTY ANTRIM FLINT ARROW HEADS.

INDEX.

Abbeys, 270
Aerated waters, 51
Algæ, freshwater, 146; marine, 144
Amphibia, 171
Antrim Round Tower, 257
Aptera, 216
Arachnida, 217
Archæan rocks, 68
Ardboe cross, 259, 260
Aves, 153

Ballinderry Church, 269
Ballymacarrett, 4
Ballypallidy plant beds, 87
Bangor, 2
Barney's Point Lias, 82
Basalts, 102; flora, 87; plateau, 59
Basic rocks, 102
Bays, 61
Belfast: aerated waters, 51; amusements, 27; castle (old), 8, 9; cathedral and churches, 23; charters and insignia, 12; colleges, 28; commerce, 33; customs, 34; description, 1, 15; distilleries, 46; docks, 5, 33; educational establishments, 28; exports, 36; gasworks, 34; harbour, 5, 33; history, 6; honorary burgesses, 14; imports, 36; linen, 38; Lough, 3; manufactures, 38; parks, 16; public buildings, 18; ropeworks, 47; shipbuilding, 42; statistics, 17; streets, 18; Technical Institute, 35; tobacco, 49; trade, 33
Black Mountain, 1
Bogs, 92
Brachiopoda, 228
Bunter rocks, 77

Calciferous sandstone, 74
Canals, 4
Carboniferous rocks, 74
Carns, 243
Carrickfergus, 2; castle, 2, 275; church of St. Nicholas, 269; salt, 56, 79
Castle Espie limestone, 76
Castlereagh Hills, 2
Castles, 274
Cave Hill, 1; caves, 252
Chætopoda, 227
Chalk, 84, 86
Churches, ancient, 265
Clandeboye, 2
Cloic-teacs, 256
Coal beds, 74
Coast indentations, 61
Cœlenterata, 233
Coleoptera, 205
Crannoges, 92, 254
Cretaceous rocks, 84
Cromleacs, 244

Crosses, 259
Crustacea, 221
Cuneiform grave slabs, 264
Cushendall quartz felsite, 99

Devonian rocks, 73
Diatomaceous earth, 92
Distilleries, 46
Divis, 2
Downpatrick Cathedral, 265; rath, 254
Drainage of district, 62
Dundrum Castle, 277, 278
Dunceltchair, 254
Dunluce Castle, 276

Echinoderma, 231
Eocene rocks, 87
Estuarine clays, 91

Ferns, 126, 127
Flowering plants, 106
Foraminifera, 238
Fungi, 138

Geology, 57
Gephyrea, 226
Giant's Ring, 244
Glacial deposits, 88; erratics, 89
Glauconite, 85
Granite, 95
Grave-slabs, 264
Grey Abbey, 271

Helen's Tower, 2
Hemiptera, 213
Hepatics, 128
Hole stones, 244
Hymenoptera, 195

Igneous rocks, 93
Inch Abbey, 273
Insecta, 195

Jurassic rocks, 80

Keuper rocks, 78
Kiesulguhr, 92
Kiste-vaens, 247

Lagan river, 4
Lakes, 64
Lamprophyres, 100
Lava flows, 102
Lepidoptera, 198
Lias, 81
Lichens, 140
Linen, 38
Lough Neagh, 64; botany, 114
Loughs, 64

MacArt's Fort, 1
Mammalia, 148
Mollusca, land and freshwater, 189; marine, 185
Mosses, 128
Mourne Mountains, 61; botany, 113; granites, 95
Movilla, 264
Musci, 128

Nematoda, 229
Nemertinea, 230
Nendrum, 271
Neuroptera, 215
Newry granites, 97

Old Red Sandstone, 73
Ordovician rocks, 70
Orthoptera, 216

Pantopoda, 221
Peat, 91, 92
Pisces, 172
Phanerogamia, 106
Physical features, 57
Plateau, basaltic, 59
Platyhelmia, 230
Pleistocene deposits, 88
Polyzoa, 229
Porifera, 236
Portrush Lias, 83
Protozoa, 238

Quartz felsite, 99

Raised beaches, 90
Rathlin Island, 67
Raths, 253
Reptilia, 171
Rhætic rocks, 81
Rhyolites, 97
Rivers, 62
Rock salt, 56, 79
Ropeworks, 47
Rotifera, 229
Round towers, 256

Salt, 56, 79
Sand dunes, 92
Scrabo Hill geology, 78
Shipbuilding, 42
Silicified wood, 66
Silurian rocks, 70
Souterrains, 249
Standing stones, 244
Stone circles, 248
Strangford Lough, 61

Tardree rhyolites, 97
Tertiary rocks, 87
Tobacco factories, 49
Toome kiesulguhr, 92
Triassic rocks, 77
Tunicata, 185

Vascular cryptogams, 106
Vertebrata, 148

Waterloo, geology, 81

McCAW
STEVENSON
& ORR
LTD

The Ulster Journal of Archæology.

A Quarterly Magazine

Devoted to Antiquarian and Historical Subjects.

Freely illustrated with Drawings, Plans, Photographs, Fac-simile Maps and MSS.

EDITED BY

FRANCIS JOSEPH BIGGER, M.R.I.A., ARDRIE, BELFAST.

The following articles, amongst others, have appeared from the pens of the best living antiquaries:

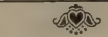
Corporate and Episcopal Seals.
Ulster Volunteers.
Memoirs of '98.
The Diocese of Derry.
The Spanish Armada in Ireland.
The Plantation Castles in Ulster.
Ulster Settlers in America.
Ancient Churches of Armagh.
The Culdees.
Bishop Jeremy Taylor's Church.
The McKinleys of Conacher.
Private Bankers in Ulster.
Franciscan Friary of Bun-na-margie.
Old Presbyterian Session Books.
Armorial Stones of the Co. Antrim.
Merchants in High Street of Belfast.
The Stewarts of Ballintoy.
The History of Tynan.
Old Abbey Church of Bangor.
Rathmore of Moylinne.
Belfast in 1800.
The Oghams at Connor, Co. Antrim.
The Colville Family.
Arthur O'Neill, the Irish Harper.
Ballygally Castle.
Old Irish Sweat-houses.
The Clogher Cross.
The Agnews in County Antrim.
Ulster Bibliography.
Abbey Assaroe.
The Church of Nendrum.
&c., &c.

Subscription: 5/- per annum; 6/- post free.

Additional Subscribers are urgently required to maintain the efficiency of the Magazine.

M'CAW, STEVENSON & ORR, Limited,
Publishers,
LINENHALL WORKS, BELFAST.

The Irish Naturalist.



A MONTHLY JOURNAL OF GENERAL IRISH NATURAL HISTORY,

AND THE OFFICIAL ORGAN OF THE

ROYAL ZOOLOGICAL SOCIETY OF IRELAND,
DUBLIN MICROSCOPICAL CLUB,
BELFAST NATURAL HISTORY & PHILOSOPHICAL SOCIETY,
BELFAST NATURALISTS' FIELD CLUB,
DUBLIN NATURALISTS' FIELD CLUB,
ARMAGH NATURAL HISTORY & PHILOSOPHICAL SOCIETY,
CORK NATURALISTS' FIELD CLUB,
LIMERICK FIELD CLUB.

EDITED BY

GEORGE H. CARPENTER, B.Sc.Lond., and R. LLOYD PRAEGER, B.A., B.E., M.R.I.A.

The following are among the recent contributors to the Journal:

Lionel E. Adams.
Captain G. E. H. Barrett-Hamilton.
Rev. G. R. Bullock-Webster.
Rev. O. Pickard Cambridge.
Professor J. W. Carr.
Rev. Maxwell H. Close.
Professor Grenville Cole.
W. E. Collinge.
T. A. Coward.
G. C. Crick.
W. L. Distant.
G. Claridge Druce.
A. H. Foord.
Rev. Hilderic Friend.
Professor Marcus Hartog.
E. W. L. Holt.
W. F. de Vismes Kane.
Rev. E. F. Linton.
Professor W. C. McIntosh.
Rev. E. S. Marshall.
Carleton Rea.
T. Mellard Reade.
Rev. W. Moyle Rogers.
Thomas Rogers.
Hon. N. C. Rothschild.
Professor W. J. Sollas.
Dr. R. F. Scharff.
Robert Standen.
J. W. Taylor.
Professor D'Arcy W. Thompson.
R. J. Ussher.
William West.
H. F. Witherby.
Joseph Wright.
Lieutenant-Colonel J. W. Yerbury.

Monthly 6d.

Annual Subscription, post free to any address, 5/-

DUBLIN:
EASON & SON, LTD., 85, MID. ABBEY ST., AND 40, LR. SACKVILLE ST.
BELFAST: 17, DONEGALL STREET.

LONDON: SIMPKIN, MARSHALL, HAMILTON, KENT & CO., LTD.

By Royal Warrant.

IRISH SCIENTIFIC PHOTOGRAPHS

PERMANENT PLATINOTYPES FOR MUSEUMS AND SCIENCE SCHOOLS.

GEOLOGICAL.

The Plateau Basalts, Cretaceous Rocks, &c., of Antrim.
Granites of the Mournes.
Dalradian Series of Donegal.
Carboniferous Sections, Fermanagh, Sligo, and N. Clare.
Silurians of Connamara.
Old Red Sandstone areas in Kerry, &c.

Lists on Application.

BOTANICAL.

Wild Flowers in their native habitats.
Great Trees, &c.

ZOOLOGY.

Wild Birds' Nests and Breeding Resorts.
Mollusca—Typical habitats, Land, Freshwater and Marine.

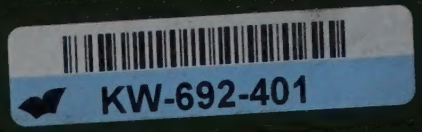
Lantern Slides supplied to order.

R. WELCH,

Photographer to the late Queen Victoria,

BELFAST.

Printed by
M'Caw, Stevenson & Orr, Ltd.,
Linenhall Press,
Belfast.


KW-692-401